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PHYSICIANS' ROLE IN PATIENT ERGONOMICS:

A PILOT STUDY

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DEDICATION

For Marmee, Papa, Malin, Lisa, Mike, and Julie who help me to

keep my mind filled with new ideas and

understand that I am already all of the things that I seek to be.

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ABSTRACT

With the ever-increasing rate of the integration of technology, and office workers making up the largest single sector of occupations, many workers are spending an increasingly large portion of their work time in the prolonged sitting or standing position and while on computer-based systems. Evidence-based research suggests that increased sedentary time is associated with diabetes, hypertension and other mortality causing diseases such as cardiovascular disease. There is a lack of occupational medicine considerations, specifically ergonomics, incorporated into the patient plan of care in the primary care setting. This is likely due to the decreased number of physicians specializing in occupational medicine (OM), and the lack of OM education in medical school curriculum. The current time constraints of the medical system may make the integration of additional screening seem unreasonable. With the introduction of occupational therapy as a contributing member of the primary care team, the burden of ergonomic training and education for at-risk patients can be reduced. Through participation in the *Physicians' Role in Patient Ergonomics* workshop, a 20-minute online video aimed at explaining the connection between occupational risks and common health issues seen in the primary care setting, physicians can learn about the implications of occupational risks on patient

health, and how to utilize brief screening questions and decision trees to efficiently determine which patients may benefit from ergonomic education and training.

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LIST OF ABBREVIATIONS

AAFP .....American Academy of Family Physicians

ACA ..... Patient Protection and Affordable Care Act

ACGME ..... Accreditation Council for Graduate Medical Education

AOTA ..... American Occupational Therapy Association

BLS .....Bureau of Labor Statistics and Analysis

CDC .....Centers for Disease Control and Prevention

HHS ..... Department of Health and Human Services:

IOM .....Institute of Medicine

MSD ..... Musculoskeletal discomfort/disease

NIOSH .....National Institute for Occupational Safety and Health

NSC .....National Safety Council

OM ..... Occupational Medicine

OT ..... Occupational therapy

POC ..... Plan of care

T2DM ..... Type-Two Diabetes Mellitus

USPSTF .....United States Preventative Services Task Force

CHAPTER ONE – Introduction

Over the last 50 years, occupational physical activity trend analysis indicates that occupations that once required more intensive physical activity have evolved, due to the integration of technology, into occupations that require much less physical activity, resulting in increased sedentary time (Church et al., 2011; Dunstan et al., 2013). Evidence-based research suggests that increased sedentary time is associated with diabetes, and other mortality causing diseases such as cardiovascular disease (Wilmot et al., 2014). It is estimated that half of the U.S. workforce are required to spend some amount of time on a computer/screen-based system (Amick, Swanson, & Chang, 1999; Bureau of Labor Statistics [BLS], 2005; The National Institute for Occupational Safety and Health [NIOSH], 1999). Past evidence-based research suggests that time spent in prolonged sitting and standing, awkward postures, and repetitive movements has a deleterious effect on the musculoskeletal and physiological systems of the human body (Amick et al., 1999; Bahk, Kim, Jung-Choi, Jung, & Lee, 2012; Baker et al., 2018; BLS, 1995; Church et al., 2011; Dembe, Erickson, Delbos, & Banks, 2005; Dempsey et al., 2016; Dunstan et al., 2013; Karakolis, Barrett, & Callaghan, 2016; National Safety Council [NSC], 2018a; NSC, 2018b; Mehrprarvar et al., 2014; Tissot F, Messing, & Stock, 2009; Tuchsen, Hannerz, Burr, & Krause, 2005; NIOSH, 2018; Wilmot et al., 2012).

It is estimated that 25% of total workers compensation costs, which is approximately $15.1 billion a year, will be due to workplace overexertion (NSC, 2018a; NIOSH, 2018). The top work-related injury cause reported by the NSC (2018b), is

overexertion and bodily reaction which makes up 33.7% of all non-fatal work-related injuries. Overexertion is classified as excessive physical effort while in contact with objects and equipment, and includes non-impact related injury (e.g. lifting, pushing, carrying), and repetitive motion injuries, which are described as microtasks resulting in strain due to repetitive movements (NSC, 2018b).

A recent CDC (2018a), report on the prevalence of diabetes in the united states suggests that 9.4% of the US population, which is 30.3 million people, have diabetes. The CDC goes on to provide statistics for pre-diabetes which shows that 33.9% of the adult US population are pre-diabetic, which is 84.1 million adults 18 years or older. The CDC (2017), reports that 33.2% of adults aged 20 and over have hypertension (measured high blood pressure and/or taking antihypertensive medication

Evidence-based studies have shown the negative impact of sedentary behavior on individuals with diabetes and hypertension, making this population more vulnerable to exposure to occupational risk factors (Wilmot et al., 2003; Dempsy et al., 2016).

When we consider the impact of musculoskeletal disease (MSD), hypertension, and diabetes and their correlation with ergonomic risk factors, we can surmise based on the prevalence of MSD and diabetes, that the connection between sedentary and static behavior (prolonged sitting/standing) and overall health and wellness of the US population needs to be taken seriously, especially with the rising concern of healthcare costs in the United States.

The core purposes of the pilot study of the *Physicians' Role in Patient Ergonomics* workshop are: (1) to determine if the information presented in an ergonomic

workshop is previously unknown to the physicians, (2) if the information is retained, (3) and whether information has been translated to a change in practice behavior by the physician evidenced by the integration of ergonomic principles into the patient plan of care (POC). The *Physicians' Role in Patient Ergonomics* workshop aims to introduce ergonomic principles to primary care physicians. It is hoped that by highlighting the relationship between health issues and ergonomic risk factors, that physicians will understand the value of incorporating these ergonomic principles into the patient POC. The *Physicians' Role in Patient Ergonomics* workshop will be presented in an online 20-minute educational video.

Since the term that is currently used in medicine is patient, from this point forward clients will be referred to using the term patient in this doctoral project. As the impact of the aforementioned health risks associated with exposure to ergonomic risk factors is great, it is important that patients begin to receive proper ergonomic training. Training patients in ergonomic principles that are tailored to their specific needs and current health limitations may encourage patients to take a role in their own health and wellness. The current discussion now must be, who is best positioned to provide this education? The Institute of Medicine (IOM) and the American College of Physicians have designated physicians as responsible for screening and managing occupational related conditions (Michas & Iacono, 2008). As primary care physicians' patient population have a multitude of varying health issues to be addressed, it is reasonable that the initiative of ergonomic principle integration begins in the primary care setting. Metzer, Hartmen, and Lowenthal (2012) explain, that the Affordable Care Act (ACA)

suggests that primary care should encompass an expansive amount of personal health needs and defines primary care as:

> The provision of integrated, accessible health care services by clinicians who are accountable for addressing a large majority of personal health care needs, developing a sustained partnership with patients, and practicing in the context of family and community § 3502 (p. 266)

Through a pilot study of the *Physicians' Role in Patient Ergonomics* workshop, it is hoped that physicians will increase their knowledge of ergonomic principles and incorporate these principles into the patient POC through preventative screening and referrals to occupational therapy practitioners for ergonomic education and training.

Contributing Factors

Based on a review of the available evidence-based literature on the topic, it is clear that there is a lack of occupational health, specifically ergonomics, education in the medical school curriculum (The Accreditation Council for Graduate Medical Education [ACGME], 2018a; Frazier et al., 1999; Michas & Iacono, 2006; Russ et al., 2012; Smits et al., 2011; Yildiz, Bilar, Camur, & Caman, 2012). Instead, medical education focused on occupational health is found primarily in the specialization of occupational medicine (OM). This specialized focus is achieved as part of a 24-month residency program in the specialization of preventative medicine (The Accreditation Council for Graduate Medical Education [ACGME], 2018b). The residency program of preventative medicine includes three concentrations: (1) aerospace medicine, (2) occupational medicine, and (3) public health and general preventative medicine (ACGME, 2018b). For the purposes of this

discussion, OM will refer to occupational medicine and public health and preventative medicine.

One aspect of the specialty of OM is to address ergonomic risk factors faced by patients in the work environment. This makes OM specialists the ideal population of physicians to address the increasing occupation-related health concerns of patients. However, according to the IOM there is a national shortage of occupational and environmental medicine physicians (Castorina & Rosenstock, 1990). The IOM (1990), estimated a shortage of OM physicians. This shortage was determined by looking at the estimated number of needed physicians, board-certified or with a specialty in OM, minus the estimated supply of available physicians (1200 to 1500). This number included the OM physicians required to provide coverage as academic faculty, as well as community-based physicians, and in local and state agencies (Castorina & Rosenstock, 1990). In a recent national assessment of the occupational safety and health workforce in 2010, the national total number of occupational safety and health professionals employed in OM was estimated at 1455 (McAdams, Kerwin, Olivo, & Gosksel, 2011). This number is close to the 1990's supply of 1200 to 1500 estimated by Castorina and Rosenstock (1990). Based on the increased utilization of technology in the workforce resulting in an increased occurrence of sedentary behavior and MSD risks, it could be surmised that today's estimated need number may be higher than that suggested by Castorina and Rosenstock in 1990 (4600 to 6700). That would make the estimated shortage even greater than what we can currently estimate with available statistics from 28 years-ago. The shortage of available physicians specialized in OM not only reduces the available faculty

in medical schools and presence in the primary care setting, but also reduces available public health physicians in state and local agencies (Castorina & Rosenstock, 1990; Michas & Iacono, 2008). Because of the shortage of OM specialists, it is increasingly important that primary care physicians are trained to screen and care for patients with occupational injuries (Michas and Iacono, 2008).

The program requirements concerning MSD listed for graduate medical education in family medicine require residents to complete a minimum of 200 hours of patient care with a range of musculoskeletal problems, which must also include structured sports medicine (ACGME, 2018a). However, there is no mention of occupational health or ergonomics specifically, or reference to preventative screening for musculoskeletal disease. Instead, the above-mentioned requirements suggest that this approach is tertiary in nature. Also, of concern, is that recent evidence-based research highlights the important and significant risk factor of an occupational setting, is its relationship to increased sedentary behavior (Church et al., 2011; Dempsey et al., 2016; Wilmot et al., 2012). The previously mentioned requirement of experience with musculoskeletal disease, simply would not address this aspect of occupational health.

A review of the evidence-based research suggests that occupational-based medicine is not as popular as other specialties amongst physicians, and that medical students have shown a negative attitude towards, and lack of interest in, the specialty of OM (Frazier et al., 1999; Russ et al., 2012; Smits et al., 2011; Yildiz, Bilar, Camur, & Caman, 2012). Yildiz et al. (2012) explains, it is essential that physicians have a favorable attitude towards, and basic understanding of occupational health, as their role is

to prevent diseases and promote health.

Time constraints may affect physician's willingness and ability to incorporate ergonomic screening into primary care office visits. With an exorbitant amount of preventative screening already required by physicians, additional preventative screening may be considered unreasonable (Yarnall, Pollak, Ostbye, Krause, & Michener, 2003). One way to address this shortage would be to utilize other occupational health specialists (individuals in separate disciplines that are trained in occupational health principles) outside of OM physicians that can reduce physician burden by training and educating patient's in ergonomic principles (McAdams et al., 2011).

Occupational Therapy Practitioners Role

From the evidence-based literature and increasing public concern for improved health and wellness at work, we can surmise that occupational health, specifically ergonomics, is a topic that is not going away. It is crucial that we acknowledge the limitations and time constraints of the current medical system and find methods by which patients can be screened for and receive ergonomic training and education. This is where occupational therapy practitioners can serve as the treatment team in the primary care setting, by providing ergonomic training to patients that are found to be exposed to the occupational health risks associated with a sedentary lifestyle, awkward postures, and repetitive movements.

As evidence-based research suggests that physicians have less understanding of OT's role when compared to other disciplines, it is crucial that the *Physicians' Role in Patient Ergonomics* workshop includes a thorough explanation of OT's practice

framework as it relates to preventative health and primary care (Halle, Mroz, Fogelberg, & Leland, 2018; Donnelly, Brenchley, Crawford, & Letts, 2013). Primary care models in countries outside of the United States have demonstrated positive results when occupational therapy has been included in the patient POC (Halle et al., 2018). These results include, but are not limited to, enhanced quality of life and function, and the reduction of accidental falls (Halle, et al., 2018).

Any loss of function that results in the decreased ability of an individual to perform daily occupations, has the potential to negatively impact patients. Evidence-based research suggests that pain and disease can negatively impact a person's ability to perform daily occupations and result in a decrease in health-related quality of life (Kielhofner, 2009; Persson, Lexell, Rivano-Fischer, & Ecklund, 2013; Sprangers et al., 2000; Roux et al., 2004).

Kielhofner (2009) explains, the core constructs of the contemporary paradigm of occupational therapy include: (1) acknowledging the significance of occupation to health and wellness, (2) acknowledgment of occupational deficits, and (3) a focused occupation-based approach. The term occupation is any task that occupies an individual's daily life and contributes to the formulation of their self-concept (Kielhofner, 2009). By this definition, work and a person's ability to effectively and efficiently perform their work tasks, falls into the scope of practice for occupational therapy practitioners. Occupational therapy practitioner's extensive knowledge-base in task analysis allows for training in all areas of activities of daily living, not limited to the work setting. By acknowledging the importance of occupation to health and well-being, recognizing the challenges/potential

risks to the completion of occupations, and understanding disease causation and process, occupational therapy practitioners can counsel/problem solve, modify environments, and provide necessary technical devices to optimize occupational performance (Kielhofner, 2009).

Through the addition of evidence-based screening questions that will flag patients at risk for ergonomic risk factors including sedentary behavior, awkward postures and repetitive movements (Appendix A), how-to guides/decision trees for equipment recommendations and occupational therapy referrals (Appendix B), the burden on physicians to incorporate ergonomic screening can be reduced.

Outline of Needs Assessment and Program Development Activities

Analysis and synthesis of current physician education curriculum and accreditation board standards for occupational health and ergonomic education will be required to comprehensively understand the current knowledge-base of physicians. This will be carried out through an investigation of the current education requirements of the ACGME, specifically, program requirements for graduate medical education in family medicine. If it is indicated that there is a lack of education requirements in inclusion of occupational health education or specialization in the field, a review of available evidence-based literature of current physician attitude/appeal towards occupational health specialty will be carried out. To assist with creating a program that is rooted in an evidence-based approach, a search, review, and synthesis of evidence-based literature on previous studies/programs geared at increasing the knowledge of physicians in occupational health, specifically ergonomics, will be completed.

To support the need for physicians to incorporate ergonomic principles into the patient POC, evidence-based research will be presented that highlights the relationship between ergonomic risk factors to the physician's typical patient population. This information will be collected via the analysis and synthesis of evidence-based research regarding the risk of musculoskeletal and physiological disease in relationship to a sedentary lifestyle, awkward postures, and repetitive movements.

In order to outline occupational therapy practitioner's role in providing the patient with education and training in ergonomics, language from the American Occupational Therapy Association (AOTA), Occupational Therapy Practice Framework (3rd edition) will be used. In addition, a search, analysis, and synthesis of the evidence-based literature on the impact of disease and dysfunction on occupational performance and health related quality of life will be conducted.

Summary

Through a review of the evidence-based literature the development of the *Physicians' Role in Patient Ergonomics* workshop will be carried out. It is anticipated that the workshop will provide valuable insight into the perceived benefit of the program to physicians and allow for conclusions to be drawn as to whether changes should be made to the program.

The results from the workshop will contribute to the existing evidence base for existing literature in OM and rationalize the inclusion of OM education into medical school curriculums. If the pilot study results indicate that there has been an increase in referrals to OT by physicians, this will help to solidify OT's role in as a part of the

primary care team. It is anticipated that the long-term outcome of this program will be the increased education and training of patients in ergonomic principles to maintain/increase their health-related quality of life.

CHAPTER TWO – Project Theoretical and Evidence Base

As stated in the previous chapter, analysis and synthesis of evidenced-based literature on the existing knowledge and typical practice of primary care physicians in regard to patient's occupational risk exposure will be carried out. This chapter will analyze and synthesis the evidence-based literature to outline the explanatory model of the identified problem. It is important that we are assure that the evidence is aligned with the explanatory model.

Proposed Explanatory Model of Identified Problem

When creation of the workshop began it was deemed important to understand the origin of the problem, why are physicians not taking a greater role in performing preventative screening that incorporates consideration of ergonomic principles? An explanatory model was developed to provide insight into the problem and its influencing factors (Appendix C). Through the creation of this explanatory model it was determined that the origin of the problem is the lack of knowledge of physicians in occupational medicine (OM) principles, specifically ergonomics. The main contributing factors to the origin of the problem is the lack of OM specialized physicians and lack of OM in medical school curricula. This lack of knowledge, and compounding factors of increased exposure by patients to occupational risks, exacerbates the deleterious effects of the occupational risks on the musculoskeletal, physiological, psychological systems of the human body. The evidence analyzed through the explanatory model will also be utilized as the content of the *Physicians' Role in Patient Ergonomics* workshop, as it is the goal of this workshop to connect the common public health issues encountered in primary care to

occupational risks that patient's may be exposed to.

Occupational physical activity trend analysis indicates that occupations that once required more intensive physical activity have evolved into occupations that require much less physical activity, resulting in increased sedentary time (Church et al., 2011; Dunstan et al., 2013). Evidence-based research suggests that increased sedentary time is associated with diabetes, and other mortality causing diseases such as cardiovascular disease (Wilmot et al., 2014). It is estimated that half of the U.S. workforce are required to spend some amount of time on a computer/screen-based system (Amick, Swanson, & Chang, 1999; Bureau of Labor Statistics [BLS], 2005; The National Institute for Occupational Safety and Health [NIOSH], 1999). The literature suggests that time spent in prolonged sitting and standing, awkward postures, and repetitive movements has a deleterious effect on the musculoskeletal and physiological systems of the human body (Amick, et al., 1999; Bahk, Kim, Jung-Choi, Jung, & Lee, 2012; Baker et al., 2018; BLS, 1995; Church et al., 2011; Dembe, Erickson, Delbos, & Banks, 2005; Dempsey et al., 2016; Dunstan et al., 2013; Karakolis, Barrett, & Callaghan, 2016; National Safety Council [NSC], 2018a; NSC, 2018b; Mehrprarvar et al., 2014; Tissot F, Messing, & Stock, 2009; Tuchsen, Hannerz, Burr, & Krause, 2005; NIOSH, 2018; Wilmot et al., 2012).

The aforementioned public health issues of diabetes, hypertension, and musculoskeletal disease have an impact on patient quality of life, and a high cost to the healthcare system (Duenas, Ojeda, Salazar, Mico, Failde, 2016; Roux et al., 2005; Sprangers et al., 2000; NSC, 2018a; NIOSH, 2018; NSC, 2018a; NSC, 2018b; Centers

for Disease Control and Prevention [CDC], 2018a; CDC 2017). The connection between occupational risks (e.g. awkward postures, repetitive movements, prolonged positions) and the public health issues, reinforces the need for occupational risk exposure screening to take place. An area of medicine that is specialized in the detection and management of occupational risks is occupational medicine (OM) (Accreditation Council for Graduate Medical Education [ACGME], 2018b). It is reasonable then to assume that OM physicians are actively addressing this issue among patients however, there is a shortage of OM specialists in the United States (Castorina & Rosenstock, 1990; Institute of Occupational Medicine [IOM], 1989; McAdams, Kerwin, Olivo, & Gosksel, 2011). The shortage of available physicians specialized in OM not only reduces the available faculty in medical schools and presence in the primary care setting, but also reduces available public health physicians in state and local agencies (Castorina & Rosenstock, 1990). This leaves primary care physicians to compensate for the lack of OM physicians, however there is a lack of OM curricula in medical schools, which may leave primary care physicians unprepared to detect and treat patients exposed to occupational risks (Michas & Iacono 2008; Accreditation Council for Graduate Medical Education [ACGME], 2018a; Frazier et al, 1999).

Evidence Analysis to Explain the Current Service Gap

In order to test the proposed explanatory model (described previously) seven main questions guided a search of the literature on physician education and specialization, service trends, evidence of benefit to education, patient risk of exposure, correlation of behavior to disease, effects of disease on quality of life, and the role of occupational

therapy (OT) in addressing the problem. The questions were:

1. Is there evidence that there is a shortage of physicians specializing in Occupational Medicine?
2. Is there evidence that there is a lack of occupational medicine education in medical school curriculum?
3. Is there evidence that intervention/education in occupational medicine increases physicians' and medical institutions' awareness for the need and applicability of, occupational health to patient care?
4. Is there evidence that there is a lack of preventative screening for musculoskeletal discomfort and ergonomic considerations in the patient plan of care?
5. Is there evidence that patients are at increased exposure to occupational risks and that these occupational risks are correlated with diseases such as hypertension, diabetes, and musculoskeletal disease?
6. Is there evidence that disease effects quality of life?
7. What role does OT play in addressing this problem?

Multiple sources were used to answer the before mentioned questions. The use of PubMed provided literature that gave insight into determining current medical education curriculum, past investigations of occupational medicine education programs, medical student attitude toward OM, and institutional recommendations on the OM education. Although information regarding OM and current medical school curriculum was limited, the following combinations of terms proved to result in the most available literature associated with the topic: "physician OR doctor OR medical students OR primary care"

and “medical training OR medical education OR training OR continuing education” and “ergonomics OR occupational health”. From this search 42 articles were found, eight of which were initially deemed appropriate for the topic. Further information was gathered from the Accreditation Council for Graduate Medical Education (ACGME) website which provide the educational requirements and standards for all graduate medical education programs, the search focused on occupational medicine and family medicine.

Much of the epidemiological data for diabetes, hypertension, and MSD was gathered from government websites such as the Center for Disease Control and Prevention, Bureau of Labor Statistics, National Institute for Occupational Safety and Health, U.S. Preventative Services Task Force, and National Safety Council. One challenge encountered when utilizing the government websites was outdated material and non-functioning reference links.

The *American Journal of Occupational Therapy*, PubMed, and CINAHL provided a rich amount of literature on occupational therapy’s role in primary care and in addressing ergonomic risks and their association with decreased function, the effects of pain and disease on quality of life, and differing learning theories and their past application to medical school education. Utilizing terms such as “occupational therapy AND ergonomics”, “occupational therapy AND primary care”, “quality of life AND disease”, “quality of life and chronic disease”, “quality of life AND pain”, “learning theory AND medical students”, “learning theory AND adults”, “computers AND musculoskeletal disease”, “office work AND musculoskeletal disease”, “sitting AND disease”, “standing AND disease”, “sitting AND pain”, “standing AND pain”,

“computers AND low back pain”, “work AND sedentary time”, “primary care AND low back pain”, “primary care AND musculoskeletal disease”, “primary care AND ergonomics”, and “Primary care AND prevention AND pain AND ergonomics” resulted in approximately 1400 articles, this number was then reduced with the filters of: “english only”, “abstract available”, and “within the past 20 years” which reduced the number to approximately 300-400 articles. Articles were then selected by title and abstract analysis until the author felt that the before listed questions could be thoroughly answered.

Summary of Evidence for Explanatory Model

Shortage of Physicians Specializing in Occupational Medicine

In 1989 the Institute of Occupational Medicine (IOM) provided a report stating that there was a shortage of available physicians that were specialized in OM. The Provided recommendations of including six specific measures to alleviate the shortage. IOM's six specific measures to alleviate the shortage of OM physicians are: 1) increase student’s interest in the field by integrating occupational into medical school curriculum, 2) establish centers to train future teachers and researchers OM, 3) expand occupational medicine to also include environmental medicine in order to increase the available physicians competent to practice in either area, 4) increase funding to support medical school faculty members teaching and conducting research in occupational and environmental medicine, 5) increase support for residency training, and 6) create new routes to certification and accreditation in occupational and environmental medicine. A report from the IOM (1990), estimated a shortage of 3100 to 5500 physicians. This shortage was determined by looking at the estimated number of needed physicians,

board-certified or with a specialty in OM (4600 to 6700), minus the estimated supply of available physicians (1200 to 1500). This number included the OM physicians required to provide coverage as academic faculty, as well as community-based physicians, and in local and state agencies (Castorina & Rosenstock, 1990). In a recent national assessment of the occupational safety and health workforce in 2010, the national total number of occupational safety and health professionals employed in OM was estimated at 1455 (McAdams et al., 2011). This number is close to the 1990's supply of 1200 to 1500 estimated by Castorina and Rosenstock (1990). Based on the increased utilization of technology in the workforce resulting in an increased occurrence of sedentary behavior and MSD risks, it could be surmised that today's estimated need number may be higher than that suggested by Castorina and Rosenstock in 1990 (which was 4600 to 6700). That would make the estimated shortage even greater than what we can currently estimate with available statistics from 28 years-ago. The shortage of available physicians specialized in OM not only reduces the available faculty in medical schools and presence in the primary care setting, but also reduces available public health physicians in state and local agencies (Castorina & Rosenstock, 1990).

Lack of Occupational Medicine Education in Medical School Curriculum

Although primary care physicians are a sensible choice of medical providers to compensate for the lake of available OM specialists, they may be lacking the knowledge base to confidently and effectively detect and manage patients exposed to occupational risks. Although 200 hours of direct patient treatment for patients with musculoskeletal disease is required for family medicine residency it does not mention preventative

screenings or occupational health/ergonomics specifically (ACGME, 2018a). There is also a concern as this requirement simply would not address the occupational risk of patients exposed to increased sedentary time at work. There is a requirement for structured curriculum in which residents address population health, including the evaluation of health problems of the community, and notes residents must take part in specific curricula to address the breadth of patients seen in family medicine (ACGME, 2018a). With the science-based evidence available on the deleterious effects of occupational risks already discussed, occupational medicine should fall within these requirements.

A segment of family physicians' patient population will be seen for occupational medicine services. The American Academy of Family physicians (AAFP), recommended guidelines for the curriculum of family medicine programs that encourage the inclusion of OM (Michas & Iacono, 2008). A study was conducted to determine if the recommendations from the AAFP had been met, by which methods and resources have these recommendations been met, and what barriers may prevent the meeting of these recommendations (Michas & Iacono, 2008). With a response rate of 64.5%, 91.7% of responders believed that there was a need for occupational medicine training, but only 68.2% actually offered training (Michas & Iacono, 2008). It was noted that only half of the programs contacted had faculty with OM experience (Michas & Iacono, 2008). Barriers to providing this training included lack of OM specialized faculty, lack of time, decreased interest among faculty and residents, and perceived need for training in OM (Michas & Iacono, 2008). This study suggests that only two thirds of the responding

family medicine residency programs offered OM training (Michas & Iacono, 2008). When OM training topics being taught in family medicine were analyzed, ergonomics was listed as the least covered topic at 32% of training compared to the most covered topic of occupational history and physical (86.3%) (Michas & Iacono, 2008). This same study showed that when OM was offered in family medicine residency programs it was only 2% of the program (Michas & Iacono, 2008).

Occupational medicine training has traditionally not been emphasized in medical school curriculum, which may account for, or contribute to the poor attitude toward occupational health that has been noted on a global scale (Frazier et al., 1999; Smits, de Graff, Radon, Boer, van Dijk, Verbeek, 2012).

Evidence that Intervention Increases Knowledge and Integration of Information

A study was conducted analyzing medical students' participation in a public health internship program taken over the course of two months in occupational health trainings (Yildiz, Bilir, Camur, & Caman, 2012). Post-training tests showed an increase in the level of knowledge in all aspects of occupational health, most significantly for knowledge on technical precautions (Yildiz et al., 2012). This study also suggested that overall knowledge and attitude toward occupational health improved (Yildiz et al., 2012). Based on these findings it was recommended that undergraduate medical education expand to include occupational health education with focus on content, duration, and methods (Yildiz et al., 2012).

A training program to help primary care residency programs develop or improve upon their curriculum in occupational and environmental medicine was carried out by the

National Institute for Occupational Safety and Health (NIOSH), and Duke University (as cited in Frazier et al., 1999, p. 706). NIOSH and Duke University carried out a training program including, but not limited to education in planning curriculum, continuing education on occupational illnesses and injuries, and information resources (as cited in Frazier et al., 1999, p. 706). Participants included 42.5% of family practice residencies and 24.9% of internal medicine residencies in the United states (Frazier et al., 1999). With a response rate of 60.4% of attendees, it was revealed that 17 months after participating in the workshop, 65.6% of participant respondents had added lectures on occupational and environmental topics to residency curriculum (Frazier et al., 1999). Part of the workshop supplemented reference materials with occupational history taking simply by adding prompts to existing history and physical forms (Frazier et al., 1999). The addition of the screening-questions and decision tree within the *Physicians' Role in Patient Ergonomics* workshop follows this model. Many attendees from the training program noted that the information resources were one of the most helpful aspects of the training (Frazier et al., 1999). Other programs that integrated training and treatment of MSD showed positive results as well (Mcquillan, Wilcox-Fogal, Kraus, Ladd, & Fredericson, 2017). Students that participate in a student-run free clinic to address musculoskeletal discomfort showed that 19/20 students reported having an excellent experience, again supporting the notion that intervention positive feedback from participants and results in increased learning (Mcquillan et al., 2017).

Lack of Preventative Screening

An extensive search of the literature did not reveal any official preventative

screening requirements for occupational risk exposure in primary care. Existing time constraints may contribute to a lack of preventative occupational risk screening (Yarnall, Pollak, Ostbye, Krause, & Michener, 2003). Time constraints may limit physician ability to comply with preventative screening recommendations (Yarnall et al., 2003). It would require 7.4 hours per working day of preventative screening to comply with the already existing preventative screening recommendations, making it seem unreasonable to integrate additional screening (Yarnall et al., 2003). The addition of even small interventions adds significantly to the physicians' workload when applied to a large population and that any new screening may be performed at the expense of some other service already provided (Yarnall et al., 2003).

The most recent available recommendations for lower back pain prevention in primary care from the US Preventative Service Task Force (USPSTF) is from a 2005 summary document that "recommends against routinely providing [the service] to asymptomatic patients" stating that it is ineffective (USPSTF, 2005). When a provided link to the full document is followed to clarify the term, *the service*, it was found that the link does not lead to the full document. It is stated in this summary document that worksite interventions, including education, have been shown to have short-term benefits in reducing the occurrence of lower-back pain but is unable to generalize that to the primary care setting as there is a lack of current evidence (USPSTF, 2005). It is also stated in this document that no good evidence was found to support or deny that back strengthening exercise of risk modification (e.g. increased physical activity) for primary prevention of lower back pain (USPSTF, 2005). Under clinical considerations it is noted

that although evidence does not show that exercise prevents low back pain, that exercise has other benefits in the prevention of cardiovascular disease, type two diabetes mellitus (T2DM), and hypertension (USPSTF, 2005). When the provided link is followed for the full updated (2005) recommendations for lower back pain prevention, it is found that the link is no longer active. Although the information could be requested from the government through a provided telephone number, this does highlight that available information on preventative treatment options is limited and may not be easily accessible to primary care providers. There are no current recommendations in place for the prevention of lower back pain from the USPSTF. When a search was conducted and the link for low back pain prevention was followed, the section is now updated to read, "This topic is currently inactive" (USPSTF, 2018).

Patients are at Risk of Exposure to Occupational Risks and Health Problems

Epidemiological information. It is estimated that 25% of total workers compensation costs, which is approximately $15.1 billion a year, will be due to workplace overexertion (NSC, 2018a; NIOSH, 2018). In 2014, hospitals treated 3,132,271 overexertion-related injuries (NSC, 2018a). The top work-related injury cause reported by the NSC (2018b), is overexertion and bodily reaction which makes up 33.7% of all non-fatal work-related injuries. Overexertion is classified as excessive physical effort while in contact with objects and equipment, and includes non-impact related injury (lifting, pushing, carrying), and repetitive motion injuries, which are described as microtasks resulting in strain due to repetitive movements (NSC, 2018b).

A recent CDC (2018a), report on the prevalence of diabetes in the united states

suggests that 9.4% of the US population, which is 30.3 million people, have diabetes. The CDC (2018a), goes on to provide statistics for pre-diabetes which shows that 33.9% of the adult US population are pre-diabetic, which is 84.1 million adults 18 years or older (CDC, 2018a). The CDC (2017) suggests, that 33.2% of adults aged 20 and over have hypertension (measured high blood pressure and/or taking antihypertensive medication. Studies have shown the negative impact of sedentary behavior on individuals with diabetes and hypertension, making this population more vulnerable to exposure to occupational risk factors (Wilmot et al., 2003; Dempsy et al., 2016).

Work trends. With the ever increasing rate of the integration of technology, and office workers making up the largest single sector of occupations, many workers are spending an increasingly large portion of their work time in the prolonged sitting or standing position and working on computer based systems (Healy et al., 2016; Thorp et al., 2012; Church et al., 2011; Dunstan et al., 2013; Amick et al., 1999; BLS, 2005; NIOSH, 1999). Much of this sedentary time is accumulated in long bouts of sitting (at least 20-30 minutes). Multiple studies note that the workplace has been identified as a key setting in which intervention to reduce sitting time would be beneficial (Healy et al., 2016; Thorp et al, 2012). In a study by Healy et al. (2016), office workers were found to sit, stand, and step for, "78.8% ± 9.5%, 14.3% ± 8.2%, and 6.9% ± 2.9% of work hours, respectively" (p. 1787).

Prolonged sitting. Multiple studies support the notion that the total sedentary time and the manner in which this total time is achieved is related to T2DM, cardiovascular disease, hypertension, some types of cancer, and early mortality (Dunstan

et al., 2013; Dempsy et al., 2016; Wilmot et al., 2012). Dempsy et al. (2016), showed elevation of blood pressure and noradrenaline levels in individuals with T2DM with the occurrence of prolonged sitting during the work day. When prolonged sitting was broken up every 30-minutes throughout the day with bouts of simple resistive activities or light walking, workers showed a decrease in both blood pressure and noradrenaline levels. Workers reported a significant reduction in fatigue and lower back discomfort when prolonged sitting was broken up by transitioning to a standing position every 30 minutes throughout the workday (Thorp, Kingwell, Owen, & Dunstan, 2014). Prolonged sitting during work tasks has been linked to low back, shown to increase intradiscal pressures, and can to lead to disc herniation (Karakolis, Barrett, & Callaghan, 2014). Karakolis et al. (2014), showed that there was an increased occurrence of spinal flexion (a known mechanism of injury) when workers were seated for prolonged periods of time. This spinal flexion in sitting was reduced when prolonged sitting was broken up with standing (Karakolis et al., 2014).

Prolonged standing. Karakolis et al. (2014) suggests, that prolonged standing is not necessarily more beneficial than sitting, as there are similarities in intradiscal pressure and reported low back pain. Prolonged standing has also been suggested to decrease balance reactions and the ability to safely handle trunk side-loaded materials (Nelson-Wong, Howarth, & Callaghan, 2009). Workers with occupational tasks requiring prolonged standing showed an increase in the occurrence of varicose veins and nocturnal leg cramps, and an increased risk of hospitalization secondary to varicose veins **(**Bahk, Kim, Jung-Choi, Jung, & Lee, 2012, Tuchsen, Hannerz, Burr, & Kraus, 2015; **).** Tissot et

al. (2009) reported, one of the main findings in a study of the relationship between lower back pain and working postures, was that the significance of lower back pain was determined by whether or not the worker had the freedom to sit down throughout their work day. This same study found that the amount of interference in typical activities experienced often or all the time, secondary to lower back pain over the course of one-year, was 24.5% (Tissot et al., 2009).

Baker et al. (2018) discusses, the impact of standing on musculoskeletal, circulatory, and cognitive function. In a study of the effects of prolonged standing (two hours of standing) on individuals in a simulated work environment, prolonged standing showed increased discomfort in all areas of the body (most significant in lower limb and lower body), reaction time and mental state decreased, while creative problem solving increased (Baker et al., 2018).

Disease/discomfort Affects Quality of Life

Experience of pain. The experience of pain has been found to significantly interfere with different aspects of a person's life (Duenas, Ojeda, Salazar, Mico, & Failde, 2016). Detrimental effects were found in relation to a person's daily activities, physical and mental health, social relationships, and their social and technical interactions in the workplace (Duenas et al., 2016). Duenas et al. (2016) notes, the negative impact on the economic well-being of the patient due to incurred medical costs and loss of wages, as well as the burden on the healthcare system.

A longitudinal study was conducted to analyze the impact of new onset musculoskeletal disorders on quality of life with participants experiencing a spinal, joint,

or extra-articular disorder (Roux et al., 2005). This study concluded that new onset MSD have a negative impact on quality of life most significantly to the physical domain and to a lesser extent mental and social function (Roux et al., 2005). Based on these findings early treatment and primary prevention were recommended (Roux et al., 2005).

Chronic disease. A study including 15,000 patients was conducted to compare the health-related quality of life for a wide range of chronic disease patients (Sprangers et al., 2000). Cardiovascular, cerebrovascular/neurogenic conditions, renal diseases, and musculoskeletal conditions led to the most adverse sequelae, with MSD showing the poorest health related quality of life (Sprangers et al., 2000). MSD ranked amongst the poorest levels of physical functioning, role functioning, and pain (Sprangers et al., 2000). The summed rank score (lower indicates better functioning) for cardiovascular conditions, endocrinological conditions, and musculoskeletal conditions were 37, 49.5, and 78.5, respectively (Sprangers et al., 2000). It was notable that individuals with comorbid conditions reported the poorest levels of mental and physical dysfunction (Sprangers et al., 2000). This study noted that hypertension, heart condition, and T2DM have a high comorbidity occurrence rate (Sprangers et al., 2000).

Occupational Therapy's Role

The notion of introducing occupational therapy into the primary care setting is not new. Primary care models in countries outside of the United States have demonstrated positive results when occupational therapy has been included in the patient POC (Halle, Mroz, Fogelberg, & Leland, 2018). There is an increased focus on a multidisciplinary

approach in primary care which will inevitably result in the integration of other disciplines into the primary care setting (Donnelly, Brenchley, Crawford, & Letts, 2013).

To encourage integration of occupational risk screening into primary care within the time constraints already faced by physicians, the concept of referring patients to occupational therapy practitioners will be introduced to participants (Yarnall et al., 2003). In the national assessment of the occupational safety and health workforce report it is recommended that in order to compensate for the lack of physicians specialized in occupational medicine, that other disciplines are referred to for patient education and training (McAdams et al., 2011). The literature suggests that physicians have less understanding regarding the scope of practice of occupational therapy when compared to other disciplines (Donnelly et al., 2013; Halle et al., 2018; Metzler, Hartmann, & Lowenthal, 2012). The literature suggests that understanding OT's role, is one of the key factors to successful integration of OT in primary care (Donnelly et al., 2013). For this reason, it is of particular importance that the workshop provides a clear overview of occupational therapy's practice framework as it applies to the evaluation and treatment of the targeted population (American Occupational Therapy Association [AOTA], 2014).

Primary health care includes comprehensive care through providing preventative care and treatment (World Health Organization [WHO], 1979; Metzler et al., 2012). Personal health needs that are to be addressed in primary care, can easily be tide into the occupational therapy scope of practice when we consider all of the occupations included in OT (Patient Protection and Affordable Care Act [ACA], 2010; American Occupational Therapy Association [AOTA], 2014; Metzler et al., 2012). Evidence-based research

supports that when an individual is experiencing a disease or physical dysfunction, their ability to complete daily occupations may be negatively affected, resulting in a decrease in health-related quality of life (Kielhofner, 2009; Persson, Lexell, Rivano-Fischer, & Ecklund, 2013; Sprangers et al., 2000; Roux et al., 2004). When occupational problems perceived by individuals with chronic pain was investigated, it was found that working, sitting, and cleaning were the most frequently reported problems (Persson, Lexell, Rivano-Fischer, & Ecklund, 2013). Kielhofner (2009) explains, the significance of acknowledging the role that occupation plays in health and wellness, and that occupational deficits are a primary focus of the occupation-based approach of occupational therapy. It is recognized within the framework of occupational therapy that an individual's ability to perform and engage in meaning occupations play a large role in an individual's self-concept (AOTA, 2014; Kielhofner, 2009). By understanding the importance of occupation to health and well-being, recognizing the challenges/potential risks to the completion of occupations, and understanding disease causation and process, occupational therapy practitioners can counsel/problem solve, modify environments, and provide necessary technical devices to optimize occupational performance (Kielhofner, 2009).

Summary of Evidence

The evidence suggests that the lack of occupational medicine considerations, specifically ergonomic, incorporated into the patient POC in the primary setting is likely due to the decreased number of physicians specializing in OM, and the lack of OM education in medical school curriculum. The literature reveals the there is an increasing

occurrence of prolonged sitting and standing and computer based-work performed by the American workforce, and compounding risks of physiological and musculoskeletal dysfunction associated with these occupational risks. The current time constraints of the medical system make the introduction of additional screening seem unreasonable. With the introduction of OT as a contributing member of the primary care team, the burden of ergonomic training and education for at-risk patients can be reduced.

Theoretical Base to Support the Project Design

Relaying the most relevant information from the above synthesized literature to primary care physicians and medical institutions will shift the perspective of the medical system to one that can see the plausibility and responsibly of incorporating occupational risk exposure screening and occupational health training to patients. This section will discuss the basis for the design of information delivery, the rationalization of prioritized content, and the model that connects OT to this problem.

Mayer's cognitive theory of multimedia learning and Knowles adult learning theory are the basis for the design of information delivery, as there is evidence-based research that shows medical education programs that utilize these theories result in increased learning (Issa et al., 2011; Issa et al., 2013). In a pre- and post-test control design, a group of 3rd year medical students attended a lecture consisting of slides designed according to Mayer's evidence-based principles (Issa et al., 2013). When this group was compared to students that attended a lecture on the same topics but without Mayer's guidelines, it was found that the group that learned following Mayer's principles showed increased learning, learning retention, and learning translation (Issa et al., 2013).

Cognitive Theory of Multimedia Learning

Cognitive Theory of Multimedia Learning rests on the main principles that there is an auditory and visual channel for processing information, and that these channels have a limited capacity to process information (David, 2015; Mayer, 2009; Issa et al., 2011; Issa et al., 2013). It is through these channels that information is filtered, organized, and integrated with prior knowledge so that new learning takes place (David, 2015; Mayer, 2009; Issa et al., 2011; Issa et al., 2013). Cognitive Theory of Multimedia Learning provides guidelines to media design and presentation to reduce the risk of overloading the aforementioned channels and explains what specific combinations of media result in the *most* learning (David, 2015; Mayer, 2009; Issa et al., 2011; Issa et al., 2013). An example of a principle that will be applied throughout the workshop, and that influenced the choice of an animation presentation, is the multimedia principle. This principle states which states that words combined with pictures results in a deeper level of learning than words alone (David, 2015; Issa et al., 2011; Issa et al., 2013; Mayer, 2009). The *Physicians' Role in Patient Ergonomics* workshop will be tailored to fit the design principles recommended in Cognitive Theory of Multimedia Learning as closely as possible (Mayer & Moreno, 2003; Mayer, 2009).

Knowles' Adult Learning Theory

Knowles' Adult Learning Theory explains, that adult learners require information to be deemed applicable to their needs to be considered valuable (Knowles, 1984). For this reason, a major component of the workshop will consist of relating health issues commonly seen in primary care to ergonomic risk factors. This will make the information

relevant to the physicians and encourage internal motivation to learn (Knowles, 1984). The adult learning theory regards the adult learning as already having existing knowledge, and it is the integration of this existing knowledge with the working memory (new information) that assists with retention of this new information and the formation of new schema (Knowles, 1984; Issa et al., 2011; Issa et al., 2013). Adult learners are considered active learners and benefit from participating in the learning process; active problem solving will increase learning (Knowles, 1984). By providing how-to tools and encouraging their use, physicians can actively problem solve in real-time during patient treatment sessions. This learning can then be investigated through analysis of the delayed post-test questionnaires.

Biomechanical Model

The biomechanical model is the model by which we can rationalize occupational therapy's role in addressing this topic. The biomechanical model addresses maintaining biomechanical capacity, as the capacity for movement affects occupational performance. When biomechanical dysfunction originating from injury or disease is present, there will be a resulting instability, the presence of instability will lead to the decreased ability to efficiently participate in daily occupations. It is within this model that the connection of MSD, health issues, and decreased health related quality of life can be made (Kielhofner, 2009). This places the problem within the scope on practice for occupational therapy on multiple levels. Not only can OT play a role in training patients to reduce their occupational risk exposure, but OT's practice framework is one that supports that the

quality of life is an important part of an individual's overall health and wellness (AOTA, 2014).

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CHAPTER THREE – Description of the Program

Introduction

Evidence-based research indicates that physician education in occupational medicine (OM), specifically ergonomic principles, is lacking and that there is a shortage of physicians that are specialized in OM. (The Accreditation Council for Graduate Medical Education [ACGME], 2018; Castorina & Rosenstock, 1990; Frazier et al., 1999; Michas & Iacono, 2006; Russ et al., 2012; Smits et al., 2011; Yildiz, Bilar, Camur, & Caman, 2012). The risks of a sedentary lifestyle and musculoskeletal discomfort/disease (MSD) are faced by many individuals, especially those who are in the workforce (National Institute of Occupational Safety and Health [NIOSH], 2018; Wilmot et al., 2012; Healy et al., 2016; Thorp et al., 2012; Church et al., 2011; Dunstan et al., 2013; Amick, Swanson, & Chang, 1999; BLS, 2005; NIOSH, 1999). Because individuals in the workforce may be exposed to ergonomic risk factors, it is important that primary care physicians are knowledgeable about the risks that a segment of their patient population may face (Michas & Iacono, 2006).

The *Physicians Role in Patient Ergonomics* workshop is an educational video presented through mixed media, exploring ergonomic principles and their relation to health issues commonly seen in primary care including; cardiovascular disease, hypertension, type- two diabetes mellitus (T2DM), and MSD (Appendix D). Activities will include participation by physicians in an ergonomic workshop that reviews the deleterious effects of prolonged sitting/standing, awkward postures, and repetitive movements (Amick, et al., 1999; Bahk, et al., 2012; Baker et al., 2018; BLS, 1995;

Church et al., 2011; Dembe, Erickson, Delbos, & Banks, 2005; Dempsey et al., 2016; Dunstan et al., 2013; Karakolis, Barrett, & Callaghan, 2016; Healy et al., 2016; Mehrprarvar et al., 2014; Thorp et al., 2012; Tuchsen, Hannerz, Burr, & Krause, 2005; NIOSH, 2018; Wilmot et al., 2012).

The presentation style of the workshop will be designed based on the principles of Mayer's cognitive theory of multimedia learning (Issa et al., 2011; Issa et al., 2013). Specifically, it will follow the structure of a study on the learning retention of 3rd year medical students, which suggested that the use of Mayer's multimedia design principles applied to a medical lecture has significant effects on long-term transfer and long-term retention of information (Issa et al., 2013). Knowles' (1984), adult learning theory will provide the foundation for designing information content and delivery methods.

One differing aspect from Mayer's study, will be that the first phase of the ergonomic workshop (pilot study phase), will not have a comparison group. In the pilot study phase, participants will be asked to complete pre- and post-tests, one-week post-test, and four-week post-test to evaluate immediate information retention, delayed information retention, and information translation.

Objectives and Intended Program Outcomes

The objectives of the *Physicians' Role in Patient Ergonomics* workshop are: (1) to increase the knowledge of physicians regarding impact of repetitive movements, awkward postures, and prolonged sitting/standing on patient health, (2) communicate an efficient means by which to integrate ergonomic principles into primary care, and (3) collect and analyze data from pre- and post-test questionnaires.

The short-term, intermediate, and long-term **Intended Program Outcomes** of the *Physicians' Role in Patient Ergonomics* can be referred to in Table 3.1.

Table 3.1

Intended Program Outcomes

Outcome level	
Short-term	Physicians gain knowledge from the ergonomic course, and find the information presented valuable.
Intermediate	Participation in the *Physicians' Role in Patient Ergonomics* workshop leads to the integration of ergonomic screening questions into primary care. Increased referrals to occupational therapy practitioners for patient education and training.
Long-term	Patients are encouraged to incorporate ergonomic principles into daily occupations. Increased/maintained health related quality of life for patients. Integration of OM, specifically ergonomics, into medical education curriculum.

It is hoped that by connecting commonly encountered patient health issues with ergonomic risk factors, encouraging physicians to incorporate ergonomic screening into the patient plan of care (POC), establishing appropriate referral sources for patient training, and collecting and analyzing data, that the before mentioned goals and intended outcomes can be achieved.

Content

Section one. The first section of the *Physicians' Role in Patient Ergonomics* workshop will discuss the current epidemiological data of MSD, specifically, the current statistics of the most common non-fatal work injuries and the estimated workers compensation cost due to MSD. The second topic in the first section of the *Physicians'*

Role in Patient Ergonomics workshop, will be the epidemiological statistics of T2DM and hypertension in the United States. The *Physicians' Role in Patient Ergonomics* workshop will open with the aforementioned epidemiological focus in order to solidify the applicability of the workshop to the primary care population. As the adult learning theory explains that in adults, learning happens more readily when the adult learner finds the information applicable to their needs and can integrate new information with existing knowledge (Knowles, 1984; David, 2015).

Section two. The second section will begin by discussing the increasing trend of technology integration (computer work) and decrease in required physical activity in today's work tasks (Amick, et al., 1999; Church et al., 2011; Dunstan et al., 2013; Healy et al., 2016; Thorp et al., 2012; NIOSH, 1999). Evidence-based research will be synthesized and presented to address the effects of awkward postures, and repetitive motion on the musculoskeletal system. Following the discussion of the impact of awkward postures and repetitive on the musculoskeletal system, the deleterious effects of prolonged sitting and standing on the physiological functions of the body will be synthesized and discussed (Amick, et al., 1999; Bahk, et al., 2012; Baker et al., 2018; BLS, 1995; Church et al., 2011; Dembe et al., 2005; Dempsey et al., 2016; Dunstan et al., 2013; Karakolis et al., 2016; Mehrprarvar et al., 2014; Tuchsen et al., 2005; NIOSH, 2018; Wilmot et al., 2012).

There will be a specific focus on the effects of prolonged sitting on individuals with T2DM and hypertension, and the vascular and cognitive impact of prolonged standing in relation to the use of sit-stand desks. Sit-stand desks will be the only specific

piece of equipment discussed as they have recently increased in popularity and are being requested more often in the work setting (Nancy Schlesinger, personal communication, October 17, 2018).

Section three. The third section will explain that The Institute of Medicine (IOM) and the American College of Physicians have designated physicians as responsible for screening and managing occupational related conditions (Michas & Iacono, 2008). The available information on the decreased availability of OM physicians in the United States will be presented, as this will be further reinforced as to why the content of the workshop is applicable and valuable to primary care physicians (Castorina & Rosenstock, 1990; Michas & Iacono, 2008). As it can be foreseen that physicians may find the inclusion of additional preventative screening requirements unreasonable with the current time constraints that they already face, the forth section will address how to integrate efficient screening and appropriate referral sources into patient treatment sessions (Yarnall, Pollak, Ostbye, Krause, & Michener, 2003).

Section four. The forth section will begin by presenting and explaining a set of brief screening questions and a decision tree handout that can be included in patient treatment sessions. These how-to materials that will be provided, will allow the physicians to efficiently determine if a patient may benefit from ergonomic education and training. The screening questions and decision tree content will be based on evidence-based literature that has shown specific work environments, symptoms, and health conditions may indicate certain patients' exposure to occupational risks (Appendices A-B).

This section will also express the role of occupational therapy practitioners in serving as an extension of care for physicians to aid in the delivery of ergonomic training/and education to patients. The AOTA's OT Practice Framework: Domain and Process (3rd edition) (2014), the expertise of occupational therapy practitioners, and the evidence-based literature on the role of OT in primary care will be discussed.

Section five. The fifth section will summarize the major points of the workshop and provide instruction on how to access the how-to materials. When presented in the initial phase (pilot study), this section will also direct participants to complete the immediate retention post-test and remind them that they will be contacted at one- and four-weeks post-workshop to complete a questionnaire. Refer to Table 3.2 for **Workshop Learning Objectives and Content**

Table 3.2
Workshop Learning Objectives and Content

Learning Objectives	Content
The physician will be able to describe the evidence-based literature on ergonomics and epidemiological statistics to appraise its value to their patient population.	1. Providing a review of current epidemiological statistics of cardiovascular disease, T2DM, and MSD. Discuss their economic impact, and negative consequences on health-related quality of life. 2. Present evidence-based research on the risks of prolonged sitting/standing, and risks of awkward postures and repetitive movements. • Musculoskeletal- discomfort, compression/shearing forces, muscle fatigue and strain, repetitive movement injuries. • Cardiovascular- blood pressure, circulation, edema, varicose veins • Endocrine-diabetes and noradrenaline levels. • Cognitive- degraded productivity and response time following prolonged sitting/standing.

Physicians will demonstrate understanding of how to apply screening questions and decision tree tool to differentiate between appropriate and inappropriate patient referrals.	1. Provide evidence-based *how-to* materials for physicians that will aid in efficient decision-making when recommending sit/stand work stations and referring to OT. • Provide list of brief screening questions to incorporate into patient treatment sessions to determine if the patient is exposed to any ergonomic risks in their daily lives. • Provide quick reference guide for physicians that will allow for efficient review of whether a patient may benefit from a sit/stand desk referral. 2. Provide evidence-based literature on topics covered in the *Physicians' Role in Patient Ergonomics* workshop to allow for physicians to further build upon already existing knowledge.
Physicians will relate patient needs for ergonomic education and training to occupational therapy practice frame work.	1. Discuss awareness of existing time constraints that physician's face in carrying out preventative screening during treatment sessions. 2. Explain occupational therapy practitioner's role as an extension of care available to relieve physicians of the role of ergonomic educator/training. 3. Discuss benefits of occupational therapy in primary care systems in countries outside of the United States. 4. Review occupational therapy practitioner's scope of practice and expertise in task analysis. 5. Discuss importance of thorough evaluation and multisession intervention, to facilitate education retention and training in multiple areas of occupations.
Following data analysis of the program, medical institutions will examine and appraise the *Physicians' Role in Patient Ergonomics* workshop to assist with development of medical school curriculum that includes OM education, specifically ergonomics.	1. Follow a predictive quasi-experimental, interrupted time series design 2. Data results will be plotted onto a line graph. A visual inspection of the graph will allow us to begin utilization of the algorithm for analysis of data from the sum of squared deviations (SSD) (Niemeyer & Duddy, 2017). 3. Calculate C and Z statistics utilizing an excel spreadsheet. 4. Utilize inferential statistics to compare data and draw conclusions regarding physician use of resources and retention/translation of information (Simpson, 2015).

Intended Participants and Recruitment Methods

Participants

Participants will be physicians practicing in a primary care setting (family medicine, internal medicine, or general medicine), with a segment of their patient population in the workforce.

In the second year of the program, it is planned to expand the population viewing the video to include medical students, medical school educators, physician administrators, and occupational therapy practitioners.

Recruitment Methods

Recruitment flyers approved by Boston University's Institutional Review Board IRB) will be utilized in seeking participants. Recruitment flyers will be aimed at physicians practicing in the primary care setting (Appendix E). Upon delivery of the recruitment flyers, brief in-person discussions will be scheduled with physician administrators to establish a point of contact and reinforce purpose and applicability of the pilot study. Follow-up phone calls and in-person meetings will be carried out to encourage participation. Contact information of interested participants will be collected from the established point of contacts, and an initial email will be sent that introduces the author, purpose, and expectations of the *Physicians' Role in Patient Ergonomics* workshop, with an attached consent form (Appendix F). Those physicians that respond to the initial follow-up email (Appendix G) will confirm their agreement to participate through filling out and returning the consent form.

Important Features and Elements of the Workshop

IRB Approval

Permission to carry out the pilot study is required from Boston University's (BU) IRB (BU, 2018). The IRB website provides a step-by-step protocol for an IRB application. See Table 3.3 for further detail on required steps for the **Steps for IRB Approval**.

Table 3.3
Steps for IRB Approval.

Step	Action
One	Complete the required human subject protection training through the Collaborative Institutional Training Initiative (CITI program), (Appendix N)
Two	Submit expedited review application (Appendix O)
Three	obtain appropriate signatures and approvals
Four	assembly and submission of all forms and study-related documents such as recruitment material, questionnaires, consent forms etc. (Appendices E-M).

Workshop Design Theory

Mayer's cognitive theory of multimedia learning and Knowles' adult learning theory will be the basis for design of information delivery, as there is evidence-based research that shows medical education programs that utilize these theories result in increased learning (Issa et al., 2011; Issa et al., 2013). Mayer's theory rests on the main principles that there is an auditory and visual channel for processing information, and that these channels have a limited capacity to process information (David, 2015; Mayer, 2009; Issa et al., 2011; Issa et al.2013). It is through these channels that information is filtered,

organized, and integrated with prior knowledge so that new learning takes place (David, 2015; Mayer, 2009; Issa et al., 2011; Issa et al. 2013). Mayer provides guidelines to media design and presentation to reduce the risk of overloading the aforementioned channels and explains what specific combinations of media result in the *most* learning (David, 2015; Mayer, 2009; Issa et al., 2011; Issa et al. 2013). The multimedia principle, which will lead the design of the workshop, states that words combined with pictures results in a deeper level of learning than words alone (David, 2015; Mayer 2009). The *Physicians Role in Patient Ergonomics* workshop will be tailored to fit the design principles recommended in Mayer's theory (Mayer & Moreno, 2003; Mayer, 2009). See Table 3.4 for the **Design Principles of Mayer's Cognitive Theory of Multimedia Learning**.

Table 3.4
Design Principles of Mayer's Cognitive Theory of Multimedia Learning (Issa et al., 2011, p. 820)

Goal	Principle	Design
Eliminate external distractors	Coherence principle	Exclude extraneous words, pictures, and sounds
	Redundancy principle	Do not add on-screen text to narrated animation
	Temporal contiguity	Place corresponding narration and animation at the same time
	Spatial Contiguity	Place printed words next to corresponding graphs
Establish 'mental frames'	Segmenting principle	Present animation in learner-paced segments
	Modality principle	Present words as narration instead of printed text
	Multimedia principle	Present words and pictures rather than words alone

Integrate new material with prior knowledge	Personalization principle	Employ conversational style to present information

Knowles' Adult Learning Theory explains that, adult learners require information to be deemed applicable to their needs to be considered valuable (Knowles, 1984). For this reason, a major component of the workshop will consist of relating health issues commonly seen in primary care to ergonomic risk factors. This will make the information relevant to the physicians and encourage internal motivation to learn (Knowles, 1984). The adult learning theory regards the adult learning as already having existing knowledge, and it is the integration of this existing knowledge that assists with retention of new information and the formation of new schema (Knowles, 1984; Issa et al., 2011; Issa et al., 2013). Adult learners are considered active learners and benefit from participating in the learning process; active problem solving will increase learning (Knowles, 1984). By providing how-to tools and encouraging their use, physicians can actively problem solve in real-time during patient treatment sessions. This learning can then be investigated through analysis of the delayed post-test questionnaires.

Physician Resources

As Knowles explains that adult learners are active problem-oriented learners, how-to materials (Appendices A-B) and science-based reference articles will facilitate active learning and problem solving. Additional resources of evidence-based materials will allow physicians to learn beyond what is offered in the workshop and provide support for program rational by physician administrators. See Table 3.5 for **Physician Resources**.

Table 3.5
Physician Resources

Type	Resource
How-to material	Patient screening questions (Appendix A)
How-to material	Decision tree for sit-stand desks and occupational therapy referral (Appendix B)

Analysis of Program

It is through the data analysis that the program's value can be supported. The evaluation plan is outlined in greater detail in chapter four, however, a brief outline will be shared in this chapter as it is an integral part of the pilot study phase (phase one) (Appendix P). The pre-test questionnaire is five multiple-choice questions and includes one Likert scale style question (Appendix K). The immediate retention post-test questionnaire is five multiple-choice questions and three Likert scale style questions (Appendix L). The delayed retention post-test questionnaire is five multiple-choice questions and five Likert scale style questions and will be administered at one- and four-weeks post workshop participation (Appendix M). The format and timing of the pre-and post-test questionnaires follow a pervious study design utilizing Mayer's theory in educating medical students (Issa et al., 2011; Issa et al., 2013).

Program Sustainability and Macro-Level Knowledge Translation

Analysis of the program outcomes is a crucial component of the sustainability of the program as the main objective of the pilot study is that we want to know if the program is resulting in increased information retention and information translation. Successful information translation will be judged by the occurrence of utilizing how-to materials, and referrals to OT for patient education and training. This can be explored

once the pretest and first posttest are completed. The pilot study will aid in evaluating the plausibility of the program; can a brief questionnaire provide enough insight to the intended outcomes? Is it possible to assess whether or not the physician has changed their behavior? It is after these steps are taken that we can discuss any needed change in program design/implementation (Newcomer et al., 2015). The pre- and post-test scores will provide insight into whether physicians demonstrate gained knowledge (Newcomer et al., 2015). If it is revealed that physicians are not retaining information, further evaluation of the content of information and method of delivery of the information should be altered. If it is revealed that physicians are retaining information but not incorporating it into their practice setting, consideration for increased guidance on integration of how-to materials by a trained observer will be utilized.

Other methods for assuring sustainability and facilitating macro-level knowledge translation will consist of collecting narratives from past participating physicians that advocate for the *Physicians' Role in Patient Ergonomics* workshop and encourage other physicians to participate in the workshop but also express the value of the program to medical education and other medical institutions. The most impact would likely come from further research that includes change in practice of physicians, and of greater consequence, analyzing patient outcomes. The dissemination of the aforementioned research to peer reviewed journals and other professional publications, in addition to presentations at Human Factors and Ergonomic Society, and American Medical Association conferences would further solidify prolonged sustainability and knowledge translation.

Role of Personnel

Besides the creation of the program by this author, the greatest role of personnel will be recruiting participants and the dissemination of the outcomes and recruiting participants and creating relationships with physician administrators and medical education institutions. Further detail is provided in chapter six which explains the specific dissemination materials to be utilized. The author will be responsible securing funding and continuously updating the presented information as new research becomes available. The author must also forge relationship deemed beneficial for acquiring program champions and connecting with the primary and secondary audiences to advocate for program validity.

Potential Barriers

The most significant potential barrier predicted is the initial recruitment of physicians to participate in the pilot study phase of the ergonomic workshop for physicians. It is reported in the evidence-based literature that physicians may have a negative attitude toward the importance of OM and they are already facing time constraints in regard to carrying out preventative screening (Yarnall et al., 2003; Russ et al., 2012). As a result, physicians may be less interested in this topic and decline learning about an additional screening expectation that may find unreasonable to include in current practice (Yarnall et al., 2003; Russ et al., 2012). Evidence-based research suggests that when specific OM training was provided in family medicine residency programs approximately 2% of the curriculum covered OM specifically, showing that it

may be deemed of lower importance in comparison to other areas of focus in primary care (Michas & Iacono, 2006)

Although it was found that a majority of medical education faculty believed that OM education is important, only 67.9% of surveyed medical education programs offered OM specific training (Michas & Iacono, 2006). This may indicate a systemic issue of lack of available specialized faculty and interest by practicing physicians, medical students, and medical education institutions. Table 3.6 lists possible solutions to the potential barriers.

Table 3.6
Potential Barriers/Challenges and Solutions

Potential Challenges	Solutions
Physicians lack interest in the topic of OM, specifically ergonomics and are less likely to participate in the workshop	Explain the relationship between ergonomics and common health issues. Utilize epidemiological statistics for workers compensation and MSD. Epidemiological stats of T2DM statistics and relate DM to sedentary behavior incurred at work.
Physicians find it unreasonable to incorporate ergonomic education and training into patient treatment sessions	Express understanding of time constraints faced by physicians and explain OT's role as an extension of care to provide patient education and training. Explain OT's scope of practice an expertise in task analysis, cost of care reduction etc.
Medical facilities and institutions don't find value in ergonomic education for physicians.	Present recommendations from accreditation committees and government institutions expressing the need for OM and ergonomic training for patients. Present science-based evidence on lack of OM physicians in US and lack of OM in medical school curriculum.

Conclusion

It is hoped that following participation in the *Physicians' Role in Patient Ergonomics* workshop that physicians will consider the information valuable, demonstrate gained knowledge, and report the integration of the presented information and how-to materials into their patient plan of care. It is predicted that the utilization of the how-to materials and view of occupational therapy practitioners as an extension of care, will reduce the perceived burden of additional preventative screening and increase the feasibility of integrating ergonomics into primary care patient POC considerations.

CHAPTER FOUR – Evaluation Plan

Introduction

The evaluation of the pilot study of the *Physicians' Role in Patient Ergonomics* workshop will focus on the following: (1) evaluation of gained knowledge, (2) evaluation of knowledge retention, and (3) evaluation of knowledge translation into primary care patient plan-of-care (POC). Inferential statistics will be utilized to make comparisons and draw conclusions through quantitative data collection (Simpson, 2015). Inferences made through the data analysis will assist in determining the effectiveness of the Physicians' Role in Patient Ergonomics workshop in introducing ergonomic principles to primary care physicians and their incorporation of these principles into the patient plan of care (POC). Analysis of whether or not new knowledge has been gained and retained will assist in determining the value of the content presented in the ergonomic workshop.

Purpose

This evaluation follows the objective oriented model. The core purposes of this pilot study of the Physicians' Role in Patient Ergonomics workshop are: (1) to determine if the information presented in *Physicians' Role in Patient Ergonomics* workshop is previously unknown to the physicians, (2) if the information is retained, (3) and whether information has been translated to a change in practice behavior by the physician through the integration of ergonomic principles into the patient POC. This program evaluation will follow a pre- and post-test quasi-experimental interrupted time series design and will be predictive in nature (Newcomer et al., 2015). If pre- and post-test comparison scores do not show a gain in knowledge has taken place, it is still possible to show value to the

program, as a change in behavior is what is most desired. It is already assumed that the physician has existing knowledge on the effects of prolonged sitting/standing, awkward postures, and repetitive movements on cardiovascular, endocrine, and musculoskeletal health, it is the aim of the workshop to create an understanding of the relationship of these health issues to ergonomic principles. A correlation between high pre-test scores and high information translation/change in behavior scores may be expected as we know from the adult learning theory, that adult learners retain information that they find useful and applicable to field/discipline. This evaluation is needed to determine if from the *Physicians' Role in Patient Ergonomics* workshop, physicians gain knowledge on ergonomic principles and integrate this knowledge with already existing medical knowledge to form new paradigms for POC (Issa et al., 2011).

Evaluation Plan

Participants

The participants will be physicians currently spending at least part of their patient care time in Family Medicine or Primary Care. For the initial phase of the study there will be five physician participants. These physicians will participate in the *Physicians' Role in Patient Ergonomics* workshop which discusses current evidence-based research on musculoskeletal disease, cardiovascular disease, and other health issues and their relationship to ergonomic principles. If the workshop is shown to have value to physicians through the analysis of the outcome data, it is anticipated that the participant audience expand to physicians in areas of practice outside of the primary care setting. Since the *Physicians' Role in Patient Ergonomics* workshop details how occupational

therapy practitioners can play a role in reducing ergonomic risk factors through patient education, future workshop participants may expand to include occupational therapy practitioners.

Evaluation Design

Survey Evaluation

This program evaluation is objective oriented and will follow a predictive quasi-experimental, interrupted time series design (Newcomer et al., 2015). The presentation style of the workshop will be designed based on the principles of Mayer's cognitive theory of multimedia learning (Issa et al., 2011). Specifically, it will follow the structure of a past study on the learning retention of 3rd year medical students, that showed that the use of multimedia design principles applied to a medical lecture has "significant effects on learning understanding (i.e. long-term transfer and long-term retention)" (Issa et al., 2013, p. 388).

The research design for the first phase of this program will not have a comparison group, but will ask participants to complete a pre-test, immediate post-test, one-week post-test, and four-week post-test to evaluate immediate information retention, delayed information retention, with the additional analysis of reported change in physician behavior.

The purpose of this survey is to gather both summative and formative information about the outcomes and outputs respectively. From this survey, we will learn if the physicians found the information applicable to their patient population, if the content of the workshop was previously unknown information, if information provided in the

workshop was applicable to their current patient population, and whether participants had been incorporating ergonomic principles into the patient plan of care before and after the *Physicians' Role in Patient Ergonomics* workshop. From the information provided in the questions, we can return to the program to change the design, information presented etc. in order to reach desired program outcomes.

Gained Knowledge and Information Retention

Prior to the *Physicians' Role in Patient Ergonomics* workshop, the participants will complete a consent form which will provide data to the participant's area of practice. Following the consent form submission (Appendix F), a pre-workshop questionnaire with five multiple-choice questions and one Likert scale style question will be administered. The pre-workshop test will ask questions specific to the information that will be provided during the workshop (Appendix K). This approach will help to determine if the physician is already aware of the workshop information. The immediate retention post-test questionnaire will have five multiple-choice questions and three Likert scale style questions (Appendix L). The delayed retention questionnaire is five multiple-choice questions and five Likert scale style questions (Appendix M). The post-test questionnaire results will help to determine if information was retained and translated into practice.

If the physicians scores improve from the pre- to post-test, we can infer that knew knowledge has been gained. If pre- and post-test comparison scores do not show gained knowledge has taken place, it is still possible to show value to the program, as a change in behavior is what is most desired. It is already assumed that the physician has existing knowledge on the topics, it is the aim of the *Physicians' Role in Patient Ergonomics*

workshop to create an understanding of the relationship of chronic health issues to ergonomic principles. A correlation between high pre-test scores and high information translation/change in behavior scores may be expected as we know from the adult learning theory that adult learners retain information that they find useful and applicable to field/discipline (Issa et al., 2011). See Table 4.1 for **Evaluation of Gained Knowledge Design**

Table 4.1
Evaluation of Gained Knowledge Design

Dependent Variable	Independent Variable	Outcome Measure	Administration	Measurement Procedure/Data Analysis
Evidence of gained knowledge				Multiple choice questions will be developed by the author of the workshop to give insight into physician current knowledge of the main concepts to be presented in the ergonomic workshop and if the physician currently incorporates ergonomic principles into patient POC. The correct answers will be given 1 point and incorrect answers will be given 0. The multiple-choice questions score will be converted to a percentage. The pre-test and first post-test percentages will then be compared for each individual participant and again as a group. If there is an increase of 10% per individual score and 25% per group comparison it will be considered an adequate gain in knowledge.
Baseline level of knowledge	Pre-test	5 multiple choice questions and one Likert scale style question to provide insight into the physicians' current knowledge of the topics to be presented in the ergonomic workshop.	Electronic survey completed prior to participation in the ergonomic workshop	

Following *Physicians' Role in Patient Ergonomics* workshop participation, a post-test will be given to assess immediate information retention. Additional post-tests

will be given at one- and four-weeks post participation. The first section of the before mentioned post-tests will be multiple choice questions that focus on the retention of the information presented. Through comparison of the pre- and post-test scores, analysis of gained knowledge can take place. It is predicted that the physicians will retain much of the information presented as the information is meant to build upon already existing knowledge of the physicians. See Table 4.2 for an outline of the **Evaluation of Information Retention**.

Table 4.2
Evaluation of Information Retention

Dependent Variable		Independent Variable	Outcome Measure	Administration	Data Management/Analysis Plan
Evidence of information retention					Survey items will be developed by the author of the workshop to ensure that information considered of greatest relevance has been learned. Survey answers from each participant will be checked with an answer key and measured with a point system. Multiple choice questions will be considered correct or incorrect. Correct answers will be given 1 point, and incorrect answers zero. Scores will be converted into percentages for each participant and as a group. Scores of 75% will be considered evidence that learning retention has taken place.
1.	Immediate recall of information	Ergonomic Workshop	5 multiple choice questions based on information presented in the ergonomic workshop.	Electronic survey completed immediately following the ergonomic workshop	
2.	Short-term recall of information		5 multiple choice questions based on information presented in the ergonomic workshop.	Electronic survey completed 1 week post ergonomic workshop participation	
3.	Long-term recall of information		5 multiple choice questions based on information presented in the ergonomic workshop.	Electronic survey completed 4 weeks post ergonomic workshop participation	

Information Translation

To determine if information translation has taken place, the second portion of the post-test will contain Likert scale style questions that will provide insight into whether the physicians consider the information as applicable to their patient population (immediately following workshop), and whether the physicians have integrated the information from the ergonomic workshop into their patient POC considerations (short-term and long-term survey). It is this outcome that is of greatest importance in supporting that the workshop is of value. If it is found that a change in behavior has not occurred, further investigation of the participant's experience would be carried out. Short answer questions may provide insight as to the barriers of information translation/change in behavior. This may rationalize the integration of supportive informational resources for the physicians. Resources such as decision trees for patient referrals, rationalization for occupational therapists within the primary care setting, or informational websites that patients can access through their patient portals. If physicians can describe the barriers that they may find in delivering ergonomic education to their patient's, funding for the before mentioned resources may be rationalized. See Table 4.3 for an outline of the **Evaluation of Learning Translation**.

Table 4.3
Evaluation of Learning Translation

Dependent Variable		Independent variable	Outcome measure	Administration	Measurement Procedure/Data Analysis
Evidence of learning translation into practice/change in behavior					Survey items will be developed by the author of the workshop to ensure that information considered of greatest relevance has been learned. Likert scale questions will be awarded points of a predetermined value and noted on the Likert scale. These questions will indicate whether or not information gained from the workshop has been translated into practice. Likert scale scores will be converted into percentages to determine the average for each individual and the group as a whole. A score of 75% or higher will be considered successful information translation. The Likert scale questions will provide subjective information from the physicians. From these questions and the multiple-choice questions, inferential statistics will used to make comparisons and draw conclusions.
1.	Immediate learning translation	Ergonomic Workshop	3 Likert scale style questions based on predicted usefulness of the information that was presented in the ergonomic workshop.	Electronic survey completed immediately following the ergonomic workshop.	
2.	Short term learning translation		5 Likert scale style questions to determine if information has been incorporated into the patient plan of care considerations.	Electronic survey completed 1 week following the ergonomic workshop.	
3.	Long term learning translation		5 Likert scale style questions to determine if information has been incorporated into the patient plan of care considerations.	Electronic survey completed 4 weeks following the ergonomic workshop.	

Summary of Collected Data

There will be one pre-test, and three post-tests administered to each of the five participants, making for a total of 20 surveys in need of analysis. The first post-test survey will take place immediately after the workshop and the short-term and long-term

surveys will be administered following the completion of the pilot study launch at one-week post-workshop and again at four-weeks post-workshop. This information can be utilized for both a summative (did physicians find this beneficial), and formative program evaluation (content review, applicability of information).

The general themes of this survey are: prior knowledge, gained knowledge, applicability, and content. We want to know what the physicians already knew about ergonomic principles and whether or not they included ergonomic principles prior to the workshop. We also want to know if the content of the workshop was beneficial; did it provide new information or new perspective that would result in a change in physician behavior to include ergonomic principles in patient plan of care and referrals to occupational therapy practitioners?

The surveys will be administered via email as an electronic document with drop down menu answers. There will be a system in place to notify the participant if any information has not been filled out prior to submission in an attempt to minimize incomplete data. As there are only five participants, missing data could have a dramatic effect on the data comparison results.

Data Management Plan

- All documentation received before and after the workshop will be stored in the personal computer of program personnel.
- Consent forms providing identifying information and pre-workshop questionnaires will be administered prior to workshop completion and returned via email.
- Interval and ordinal coding will be used for questionnaire data.

- Categorical coding will be used to record area of practice data
- Custom forms will be generated for pre/post-test data recording
- User interface for the completion of pre/post-workshop questionnaire will be in the form of an electronic document with drop down multiple-choice questions.

Data Analysis Plan

Data results will be plotted onto a line graph. A visual inspection of the graph will allow us to begin utilization of the algorithm for analysis of data from the sum of squared deviations (SSD) (Niemeyer & Duddy, 2017). It is expected that there will be a change in level from phase 1 to the final phase. If a change in level, and slope is easily observed between the phases then we will confirm this with C and Z statistics utilizing an excel spreadsheet. If a trend is confirmed, then we will confirm significant change utilizing a celeration line analysis. If we have an equal number of data points and there is a clear difference in slope (found utilizing celeration lines), then we will confirm significant change by comparing trends using the C and Z statistics SSD (Niemeyer & Duddy, 2017). Utilizing the answers to the multiple choice and Likert scale style questions, especially those regarding reasonability of integrating screening questions, and occurrence of referrals to occupational therapy practitioners, inferential statistics will be utilized. Inferential statistics will allow for us to make comparisons and draw conclusions about the utilization of the information presented to the physicians.

Practical Considerations

The most challenging aspect of this study will be recruiting the five physicians and assuring the physicians' patient population is one that is likely to benefit from

ergonomic intervention. Because this is a pilot study and only five participants will be required for this phase, it is reasonable that this number of physicians can be recruited. It is of most importance that the physicians find value in the information and applicability to their patient population.

Conclusion

It is hoped that with this pilot study the value of integrating ergonomic considerations into the patient POC can be shown. Following the data analysis of the pilot study, we can begin to improve upon information delivery and rationalize further development of this program and like programs to advocate for physician awareness of ergonomic principles and its relationship to existing public health issues.

CHAPTER FIVE – Funding Plan

Introduction

The proposed pilot study of the *Physicians' Role in Patient Ergonomics* workshop aims to introduce ergonomic principles to primary care physicians. It is hoped that by highlighting the relationship between health issues and ergonomic risk factors, that physicians will understand the value of incorporating these ergonomic principles into the patient (POC). The *Physicians' Role in Patient Ergonomics* workshop will be presented in an online 20-minute educational video. The creation of the educational video will follow the design principles of Mayer's Cognitive Theory of Multimedia Learning. The *Physicians' Role in Patient Ergonomics* workshop will include the presentation of evidence-based research on the effects of prolonged sitting/standing, awkward postures, and repetitive movements on cardiovascular, endocrine, and musculoskeletal health. Also included will be a discussion of current ergonomic intervention utilized as a secondary or tertiary measure; and the role that occupational therapy can play in reducing patient exposure to ergonomic risks. Information will be presented through text, graphics, animation, and case studies.

To create the *Physicians' Role in Patient Ergonomics* workshop and recruit participants for the study, it is important to consider the cost of creating the educational video and disseminating information. Following the analysis of the pilot study data, changes may be made to the *Physicians' Role in Patient Ergonomics* workshop content. From the incorporation of these changes, a second version of the *Physicians' Role in Patient Ergonomics* workshop will be created that will be more commercially appealing.

This chapter will outline the estimated cost to create and carry out the pilot study (year one) and the final form (year two) of the *Physicians' Role in Patient Ergonomics* workshop.

Estimated Costs

Pilot Study (Year One)

The most significant cost of carrying out the *Physicians' Role in Patient Ergonomics* workshop will be the preliminary expenses of the graphic design (creating the video itself). The initial phase will be professionally complied but is not expected to be of commercial quality. The utilization of the Animaker© online application subscription of $59.95 will allow for this author to create the animation and voice over in her spare time. It is estimated that this will take ~two months to complete, for a total of $119.90. Because this is the first time this author has created a video of this magnitude, consultation and guidance from a graphic designer is warranted. Based on personal correspondence with a freelance graphic designer, an estimate of $350 was provide which includes, assistance with consolidating videos, matching voice overs, creating graphics for the introduction, and providing suggestions for the project flow and execution (W. Ramirez, personal communication, May 1, 2018).

Supplies required will include: (1) access to Microsoft™ Office to create recruitment flyers, PowerPoint® outline for animation guide, and excel spreadsheet for data collection tables (author owns software), and (2) an internet subscription for access to Animaker© ($95/month). The final animation video will be accessible at no cost through YouTube©.

Pilot study dissemination costs. Materials needed for the pilot study phase will include bi-fold, 8.5” x 11”, premium glossy paper stock dissemination brochures purchased from Vistaprint® for $26 (50 brochures). Additional recruitment flyers will be created on the authors computer utilizing the previously mentioned

Microsoft™ Office software. Typeform™ online survey service will be utilized for the completion of the pre/posttest during the pilot study at a cost of $35/month for two months. Although the study is planned to be one month in length, a two-month subscription will be budgeted to account for the possibility of delayed survey responses.

Phase two of year one (after pilot study)

Material need following the pilot study phase will include Vistaprint® bi-fold, 8.5” x 11”, Premium glossy paper stock (50 copies) for $26 this will be utilized for the dissemination brochures and flyers for participant recruitment. How-to materials (e.g. screening questions, decision trees) will be created using Vistaprint® 8.5” x 11”, Matte paper stock x 250 for $120. The creation of a short advertisement video (1-2 minutes) with past physician participants advocating for the program will be made by the author and compiled by graphic designer for the amount of $200. Advertisement will be purchased for LinkedIn advertising with a set monthly budget of $300 allotted for two months for a total of $600. A review of outcomes benefit will be carried out after two months to determine if this plays a significant role in increased participation.

Final Phase (Year Two)

After the data from the pilot study has been analyzed, changes will be made to the content and media presentation methods as deemed appropriate. This will be outlined in a

story board that will be completed via PowerPoint® (Microsoft™ Office software is already owned by the author). To ensure that the information is most applicable to a physician audience, a family medicine/primary care physician will be hired as a consultant for the final phase of the workshop. According to the Bureau of Labor Statistics (2018), the median hourly rate for family medicine and general practitioners is $100.20/hr. A budget of $501 will be set aside for this aspect of final program preparation, for a two-hour initial consult, and two additional one-hour follow-up sessions to review implementation of recommended changes.

Once the content for the *Physicians' Role in Patient Ergonomics* workshop is finalized, the next step is its commercial level design to ensure that it seamlessly fits into other high-quality medical education resources. To accomplish this high level of quality will require hiring a graphic designer for animation, graphics, and video. It is estimated that the cost will be $900 (W. Ramirez, personal communication, May 1, 2018). A professional voice over artist will be hired for the final version of the PSPEW for an estimated fee of $300 (J. Jefferies, personal communication, October 8, 2018).

Phase two dissemination costs. Advertising will be aimed at medical facilities, physician education centers, and individuals through social media. A bi-fold, 8.5" x 11", premium glossy paper stock dissemination brochures purchased from Vistaprint® for $78 (250 brochures). Providing how-to materials (e.g. screening questions, decision trees) presented on 8.5" x 11", Matte paper stock created using Vistaprint® (500 copies) will cost $150 and will be distributed to brick and mortar locations in addition to an updated short advertisement video (1-2 minutes) with past physician participants advocating for

the program. The video will be made by the author and compiled by graphic designer for $200. LinkedIn advertising will be purchased ($300 monthly budget for two months pending review of advertising outcomes) in hopes of reaching a larger audience. See Table 5.1 for **Estimated Costs**.

Table 5.1
Estimated Costs

Budgeted Item	Year one	Year two	Justification
Workshop video creation/ graphic design cost	Pilot study phase • Animation through Animaker© online application subscription. $60/month x 2 months • Graphic designer consultation and oversight- $350 • Author voice over- $0.00 *Total: $410.00*	Final Form • Graphic designer Animation- $40 per minute of animation ~10 minutes of total animation-$400 • Graphics and assistance with video compilation by Graphic designer, -$500 • Professional voice over, single session- $300 *Total $1,200*	Initially the workshop will be completed with the focus being on content value (year one) Once the information to be presented is solidified, then the design of the presentation will be expected to be at commercial level, to ensure that it seamlessly fits in amongst other high-quality medical education resources (year two). Rate for voice over determined through personal correspondence with professional voice over artist Jelani Jefferies Rate for graphic designer and oversite based on personal correspondence through email with freelance graphic designer Walter Ramirez.

Supplies	Microsoft® Office Software: Owned by author: $0 Access to the online animation program via internet on author's personal computer. Internet monthly fee: $95.00 x 2- $190 YouTube access to workshop video: $0 Computer owned by author: $0 *Total: $190*	Microsoft® Office Software: Owned by author: $0 Internet monthly fee: $95 Computer owned by author: $0 *Total: $95*	Microsoft® Office Software is already owned by the author and will be of no cost. Cox communications provides internet service which will be utilized for multiple aspects of the project as noted in the text and is $95/month. The PSPEW will be viewed on YouTube and will be of no cost to the author or the participants. A laptop computer is already owned by the author and will not contribute to the estimated final total cost of the program.
Materials	Phase One (Pilot Study): Dissemination brochures and flyers for participant recruitment: Vistaprint® bi-fold, 8.5" x 11", Premium glossy paper stock x 50: $26 Recruitment flyers created on Microsoft™ Office ~ 25 flyers: $0 Printed on authors work printer (cleared with administration as a professional curtesy) How-to materials sent via email: $0 *Total: $26* Phase two (after pilot study):	Dissemination brochures and flyers for participant recruitment: Vistaprint® bi-fold, 8.5" x 11", Premium glossy paper stock x 250: $78 Providing how-to materials (e.g. screening questions, decision trees) 8.5" x 11", Matte paper stock x 500-$150 Updated short advertisement video (1-2 minutes) with past physician participants advocating for the programs- video will be made by the author and compiled by graphic designer - $200 LinkedIn advertising:	Vistaprint website pricing for brochures: https://www.vistaprint.com/marketing-materials/brochures Vistaprint website pricing for How-to materials: https://www.vistaprint.com/signs-posters?xnid=TopNav_Signs+and+Posters Recruitment flyers will be created on Microsoft word and printed on the authors work printer as a professional curtesy being that the number of copies is minimal (25 flyers), and some will be distributed within the authors place of employment.

	Dissemination brochures and flyers for participant recruitment: Vistaprint® bi-fold, 8.5" x 11", Premium glossy paper stock x 50: $26 Providing how-to materials (e.g. screening questions, decision trees) 8.5"x 11", Matte paper stock x 250-$120 Short advertisement video (1-2 minutes) with past physician participants advocating for the programs- video will be made by the author and compiled by graphic designer- $200 LinkedIn advertising: $300/month x two months: $600 (review outcomes after two months) Phase One: $26 Phase Two: $946.00 *Total: $972.00*	$300/month x two months: $600 (review outcomes after two months) *Total:$ 1,028.00*	
Other	Typeform™ online survey for initial pilot study phase $35/month x 2 months	Physician consultant will be brought on to ensure information content is at appropriate level of expertise for physician audience. Physician consult hourly rate 100.20 (5) hours: $501	Typeform website: https://www.typeform.com/ According to the Bureau of Labor Statistics the Median hourly rate for Family and General Practitioners is $100.20/hr. https://www.bls.gov/oes/current/oes291062.htm LinkedIn advertising can be set at a daily budget of $10 (monthly budget of $300) set with a

	Total: $60	*Total: $501.00*	beginning and end date that will total two months in length. https://adespresso.com/blog/linkedin-ads-everything-need-know/
Total Cost	$1,632.00	$2,922.00.	

Funding

Sponsorship and Investors

To fund the *Physicians' Role in Patient Ergonomics workshop* and the second year of the workshop, personal investment, sponsorship, company investment, and grant funding will be explored. Because the estimated cost of the pilot study is approximately $1,500.00 it is reasonable that the author/creator of the workshop can fund the initial phase through personal funding. The estimated cost of the second year of the program exceeds $3,000.00 and would require funding from sources outside of personal funding.

Because the workshop advocates for the integration of ergonomics into primary care and may result in an increase of ergonomic evaluation referrals, ergonomic companies or companies that create ergonomic equipment may be interested in investing in the creation of the workshop, or sponsoring advertisement for the workshop. Hospitals and primary care facilities may also find value in providing the workshop to their own physicians and for this reason may invest in the final phase of the workshop especially if the author is able to secure a champion physician that will advocate for the value of the workshop. Because the workshop targets the topics of musculoskeletal disease, diabetes, and cardiovascular health which are considered to be public health issues, federal or state

grants may an additional source of funding. See Table 5.2 for funding from Grants.

Table 5.2
Grants

Grant Resource	Description
Virginia Healthcare Foundation	Virginia Health Care Foundation as a public/private partnership with a mission to increase access to primary health care for uninsured and medically underserved Virginians via innovative service delivery models. https://www.vhcf.org/for-those-who-help/what-we-fund/taking-aim-improving-health/
Centers for Disease Control and Prevention	Public Health and Human Services (PHHS) Block Grant Public health professionals gateway: Block Grant Educational and community-based health programs grant: Fiscal year (FY) 2017 amount: $26,365,235 https://www.cdc.gov/phhsblockgrant/funding/blockgrant17.htm
Centers for Disease Control and Prevention	*Community Transformation Grants* Program helps communities carry out programs that prevent chronic disease and funds local organizations to help make healthy changes in their communities. https://www.cdc.gov/nccdphp/dch/programs/ctgcommunities/index.htm
U.S. Department of Health and Human Services	Agency for Healthcare Research and Quality (AHRQ) Research Funding Priorities & Special Emphasis Notices. *AHRQ announces interest in receiving applications related to innovative primary care research*. • How different configurations of primary care teams affect the effectiveness and efficiency of care and health outcomes. • How different financing models for primary care affect the delivery of high-quality care. • How to integrate primary care into larger health care systems and public health to improve health outcomes. https://grants.nih.gov/grants/guide/notice-files/NOT-HS-16-011.html

Conclusion

The first year of the *Physicians' Role in Patient Ergonomics* workshop will show the value of the information that is to be provided to the physicians. It will provide insight into whether or not the goal of increasing the consideration of ergonomic principles into primary care is reached. The second year will be centered around preparing the workshop for a larger commercial audience. Although the total initial cost for both phases is high, it is anticipated that over time there will be an income of revenue through licensing of the workshop. However, this would take place in the third or fourth year and would require additional content editing as new scientific evidence on the concerned topics is revealed. The outlined funding plan is sufficient to create a professional and commercial level workshop that will serve as a tool to reduce the ergonomic risks faced by many individuals during their daily routines.

CHAPTER SIX – Dissemination Plan

Introduction

The *Physicians' Role in Patient Ergonomics* workshop is a 20-minute educational video offered to primary care and family medicine physicians which will include evidence-based research on the effects of prolonged sitting/standing, awkward postures, and repetitive movements on cardiovascular, endocrine, and musculoskeletal health. Also included will be a discussion on the role that occupational therapy practitioners can play in reducing patient exposure to ergonomic risks. It is hoped that by highlighting the relationship between health issues and ergonomic risk factors, that physicians will appreciate the value of incorporating these ergonomic principles into the patient plan of care (POC). In addition, it is predicted that following the viewing of this educational video, physicians will increase referrals to occupational therapy practitioners for ergonomic training.

Dissemination Goals

- *Long Term Goal 1:* The dissemination of the program to the primary and secondary audiences will lead primary care physicians to integrate ergonomic principles into patient plan of care considerations.
- *Short Term Goal 1:* The dissemination of the program to the primary audience will lead primary care physicians to understand the value of incorporating ergonomic principles into the patient POC.

- *Short Term Goal 2:* The dissemination of the program to the primary and secondary audience will result in the incorporation of ergonomic screening questions into primary care office visits (Appendices A–B).
- *Short Term Goal 3:* The dissemination of the program to the primary and secondary audience will result in an increased awareness of occupational therapy practitioner's clinical role in delivering ergonomic training to patients.
- *Short Term Goal 4:* The dissemination of the program to the primary and secondary audience will lead primary care physicians to refer patients to occupational therapy practitioners for ergonomic training.

The dissemination plan discussed will take place following the evaluation of the initial phase of the program, the *Physicians' Role in Patient Ergonomics* workshop. The positive results of the pilot study will be utilized as part of the dissemination strategies to facilitate the use of the health care evidence. This chapter will outline the multiple considerations made in order to achieve the above mentioned long-term and short-term goals. It is first important that we determine the target audiences and key messages that will be directed toward those audiences. Once the audiences have been described, 1-2 influential spokespersons that would be viewed as credible by the aforementioned audiences will be identified. Dissemination activities will be explained, rationalized, and an estimated budget will be outlined. Lastly, considerations regarding an evaluation of the success of the dissemination plan will be discussed.

Primary Target Audience

The primary target audience for the dissemination strategies will be primary care/family medicine physicians. This audience will be targeted as it is the participation of the physicians that will help to disseminate the information across medicine and to medical colleagues.

Key Messages for Primary Target Audience

1. The Ergonomics for Physicians workshop is of value to primary care physicians as it will present evidence-based research outlining the relationship between ergonomics and health issues often seen in the primary care setting.
2. Ergonomic principles consider the way in which the physiological and musculoskeletal systems are affected by prolonged sitting and standing, awkward postures and repetitive movements. Evidence-based research shows that sedentary time in adults is associated with diabetes, cardiovascular disease and death (Wilmot et al., 2012). It is crucial to recognize the importance of preparing primary care physicians for the growing patient population that present to them with these issues (Frazier et al., 1999).
3. As physicians already fight time constraints while incorporating other preventative services, the addition of another preventative service may seem unreasonable (Yarnall, Pollak, Ostbye, Krause, & Michener, 2003). For this reason, physicians would benefit from referring patients to occupational therapy practitioners for ergonomic training. It is occupational therapy practitioners that can provide ergonomic training to patients that are deemed at risk for health

issues associated with a sedentary lifestyle and musculoskeletal disease following primary care screening.

Primary Influential Spokesperson

1. A primary care physician would be the most valuable spokesperson for the primary audience as the workshop's intended audience is primary care physicians. A spokesperson that has experience and an understanding to the patient population and time constraints of primary care could be viewed as an ally by other physicians, and increase physician buy-in.
2. Allison Mula, MS, OTR/L, CEAS given that she is the creator of the program and is well-versed in the current literature on the topic. Her role as an acute care occupational therapist who is specialized in ergonomics will allow her to clearly convey the relationships between disease process, ergonomic principles, and occupational therapy.

Activities

The goals of the activities planned for the dissemination to the primary audience will be to increase the reach of the evidence and increase people's motivation and ability to apply and use the evidence (Agency for Healthcare Research and Quality [AHRQ], 2012). To do this the following activities will be carried out.

- Providing how-to materials (e.g. screening questions, decision trees, suggestions for how to incorporate information) will enhance the physicians ability to apply the information in the EWP. Additional resources such as these enhance the dissemination strategy (AHRQ, 2012).

- Video case-study examples that were created for the Ergonomics for Physicians workshop will be disseminated. Narrative forms of communication targeted at our specific audience of primary care physicians, will increase the persuasiveness of the message as it will be relevant to this group's membership (AHRQ, 2012).
- Paper brochures will be disseminated to communicate messages that emphasize the benefits of integrating ergonomic principles into patient POC. Messages framed at emphasizing benefits are more beneficial than loss-framed messages (AHRQ, 2012).
- Presentation of brief advertisement-style video of primary care physicians that participated in the Ergonomics for Physicians workshop and provide testimony that emphasizes the benefits of the workshop and use of referrals to occupational therapy practitioners reducing the burden of additional preventative screening. This activity practices audience targeting and positive-framing which has been shown to be and effective strategy for evidence dissemination according to science-based evidence (AHRQ, 2012).
- In-person discussions with physicians by the primary spokespersons set-up through colleagues or dry-calls would improve the reach of the evidence (AHRQ, 2012).

Secondary Target Audience

The secondary target audience for the dissemination strategies will be physician executives. Physician executives are physicians that serve in administrative medicine and are able to serve as a liaison between administration and medical clinicians (Thomason,

1999). This audience will be targeted as it is physician executives that serve as a liaison between physicians and administration, oversee quality management programs, credential providers, and supervise physicians and strategic planning (Thomason, 1999).

Key messages to secondary target audience.

1. Evidence-based research has shown that training initiatives aimed at educating physicians in occupational health topics resulted in increased integration of occupational medicine into primary care curriculum (Frazier et al., 1999).
2. The training of primary care physicians to care for patients with occupational health injuries and that are exposed to risk s associated with a sedentary lifestyle has become a necessity. The Institute of Medicine and the American College of Physicians have stated physicians are responsible recognizing and managing disease associated with occupational health factors. (Michas & Iacono, 2006)

Primary Influential Spokespeople

1. Karen Jacobs EdD, OT, OTR, CPE, FAOTA will serve as a thought leader as she is recognized as an expert in her field and is a Fellow of the Human Factors and Ergonomics Society. She could endorse the intervention and play a role in its development (AHRQ, 2012).
2. An executive officer of medical education. This individual could serve as a champion for the dissemination of the evidence and visibly promote the Ergonomics for Physicians workshop within their organization. This may help to overcome barriers that are imposed by the current curriculum of medical schools (AHRQ, 2012).

Activities

- Advertisements on LinkedIn would help to distribute the program to more audiences and across more settings, employing more than one technique would improve the reach of the information (AHRQ, 2012).
- Brochures on that convey the Ergonomics for Physicians workshop results and highlight the benefits of the EWP will be distributed to medical facilities and medical education institutes. Information that is tailored to the audience and uses positive framing will increase the effectiveness of the dissemination (AHRQ, 2012).
- Presentation of brief advertisement-style video of primary care physicians who provide testimony that emphasizes the value of the information and the benefits of referrals to occupational therapy practitioners to reduce the burden of additional preventative screening. This activity practices audience targeting and positive-framing which has been shown to be and effective strategy for evidence dissemination (AHRQ, 2012).
- Providing how-to materials (e.g. screening questions, decision trees, suggestions for how to incorporate information) clarify how the information can be integrated into primary care preventative screenings. Additional resources such as these enhance the dissemination strategy (AHRQ, 2012).

Refer to Table 6.1 for A detailed outline of the **Budget for the Dissemination Plan**

Table 6.1
Budget for Dissemination Plan

Audience	Year One Phase 2 (after Ergonomics for Physicians workshop)	Year Two
Primary	Dissemination brochures and flyers for participant recruitment: Vistaprint® bi-fold, 8.5" x 11", Premium glossy paper stock x 50: $26 Providing how-to materials (e.g. screening questions, decision trees) 8.5" x 11", Matte paper stock x 250-$120 Short advertisement video (1-2 minutes) with past physician participants advocating for the programs- video will be made by the author and compiled by graphic designer- $200 LinkedIn advertising: $300/month x two months: $600 (review outcomes after two months) *Total: $946.00*	Dissemination brochures and flyers for participant recruitment: Vistaprint® bi-fold, 8.5" x 11", Premium glossy paper stock x 250: $78 Providing how-to materials (e.g. screening questions, decision trees) 8.5" x 11", Matte paper stock x 500-$150 Updated short advertisement video (1-2 minutes) with past physician participants advocating for the programs- video will be made by the author and compiled by graphic designer - $200 LinkedIn advertising: $300/month x two months: $600 (review outcomes after two months) *Total:$ 1,028.00*
Secondary	Dissemination brochures highlighting the outcomes of the pilot study Vistaprint® bi-fold, 8.5" x 11", Premium glossy paper stock x 50 cost accounted for in year one, primary audience section)- $0 How-to materials (e.g. screening questions, decision trees) 8.5" x 11", Matte paper stock x 250-(cost accounted for in primary audience section)- $0	Dissemination brochures highlighting the outcomes of the pilot study. Vistaprint® bi-fold, 8.5" x 11", Premium glossy paper stock x 250: (cost accounted for in year two primary audience section)- $0 How-to materials (e.g. screening questions, decision trees) 8.5" x 11", Matte paper stock x 500 (cost accounted for in year two primary audience section)- $0

	Short advertisement video (1-2 minutes) with past physician participants advocating for the programs- video will be made by the author and compiled by graphic designer (cost already accounted for in year one, primary audience)- $0 LinkedIn advertising: $300/month x two months. Review outcomes after two months (cost accounted for in year two primary audience section)- $0 *Total:$0*	Updated short advertisement video (1-2 minutes) with past physician participants advocating for the programs- video will be made by the author and compiled by graphic designer (cost already accounted for in year two, primary audience)- $0 LinkedIn advertising: $300/month x two months. Review outcomes after two months (cost accounted for in year two primary audience section)- $0 *Total: $0*
Total expenses	$946.00	$ 1,028.00

Evaluation of Dissemination Plan Success

The evaluation of the success of the dissemination plan will be based on the intermediate outcomes for the targeted audiences and the ultimate outcomes for patients and physicians (AHRQ, 2012). The intermediate outcomes will be determined by gathering feedback through surveys that give insight to the physicians' and administrator's knowledge of science-based research, self-efficacy of the physicians to utilize the information provided, and the behavioral intentions to apply the information presented in the EWP (AHRQ, 2012). The ultimate outcomes would be evaluated through follow-up surveys aimed at determining the physicians' behavior or screening methods, and the behavior and clinical outcomes of patients (AHRQ, 2012). These methods would

provide the most insight if collected over longer period of time and analyzed utilizing inferential statistics.

Conclusion

Dissemination would be most successful and achieve an increased reach of the evidence by taking a multifaceted and active approach, by utilizes more than one technique and strategy (AHRQ, 2012). Multiple types of techniques (e.g. targeted audience, narrative approach, positive-framed messages) are more effective than when only a single type of technique is utilized (AHRQ, 2012). Information dissemination that is only passive has been found to be ineffective (AHRQ, 2012).

By providing additional resources to facilitate the application and use of the evidence will also be an important aspect of this dissemination plan. It is acknowledged that there are great time constraints in the ability for physicians to incorporate preventative screening into patient-physician sessions (Yarnall et al., 2003). By providing guidance through supplemental information, application of the evidence may be more reasonable. A large part of this dissemination plan's success depends on the ability of the plan to convey that participating in the Ergonomics for Physicians workshop will provide a benefit to physicians and their patients.

CHAPTER SEVEN - Conclusion

In conclusion, the evidence-based literature suggests that with the integration of technology, many occupations require less physical activity, resulting in increased sedentary time for workers (Church et al., 2011; Dunstan et al., 2013). Evidence-based literature also suggests that a sedentary time is associated with type-two diabetes mellitus (T2DM), and other mortality causing diseases such as cardiovascular disease (Wilmot et al., 2014). Although there is a high prevalence of musculoskeletal disease (MSD) and high workers' compensation costs in the United States; and the deleterious effects of sedentary behavior to patient's health is well documented, there is a lack of evidence-based literature available on the role of primary care physicians in screening patients for exposure to these occupational hazards (NSC, 2018a; NSC, 2018b; NIOSH, 2018; Wilmot et al., 2014).

One cause for decreased integration of ergonomic education in primary care may be a lack of occupational medicine education, specifically ergonomics, in medical education curriculum (ACGME, 2018a; Frazier et al., 1999; Michas & Iacono, 2006; Russ et al., 2012; Smits et al., 2011; Yildiz, Bilar, Camur, & Caman, 2012).

This doctoral project discussed the creation, implementation, and evaluation of the *Physicians' Role in Patient Ergonomics* workshop, a multimedia workshop for primary care physicians that was designed to provide evidence-based information about the relationship between ergonomic principles and commonly seen health care issues. This workshop will help to facilitate the integration of ergonomic principles into primary care physicians' plan-of-care (POC) considerations. It is anticipated that this will be

achieved by presenting epidemiolocal statistics to link occupational risks to commonly encountered patient health issues and describing OT's role as a referral source for patient ergonomic education and training. The most crucial aspects for the sustainability and success of this workshop is the inclusion of evidence-based literature, physician participation, and information dissemination. First, how the theory and evidence were integrated into this workshop will be reviewed. Secondly, a brief description of the program content selected to maximize physician interest will be explained. Third, the plan for evaluation of the program and how it may impact occupational therapists, physicians, and medical education will be discussed.

Integration of Theory

Mayer's cognitive theory of multimedia learning (CTML) and Knowles' adult learning theory (KALT) are the basis for the design of information delivery, as there is evidence-based research that suggests medical education programs that utilize these theories result in increased learning (Issa et al., 2011; Issa et al., 2013). The biomechanical model was utilized to explain the relationship of disease and discomfort, to decreased health-related quality of life.

Integration of Evidence

The evidence-based literature in this workshop is of importance as this will be the tool by which the relationship between commonly seen health issues in the primary care setting and ergonomic risk factors, specifically prolonged sitting/standing, awkward postures, and repetitive movement, will be conveyed. By connecting the deleterious effects prolonged sitting/standing, awkward postures, and repetitive movements to

commonly seen health issues in primary care, it is hoped that physicians will consider the information presented to be of value to their patient population (Amick, Swanson, & Chang, 1999; Bahk, Kim, Jung-Choi, Jung, & Lee, 2012; Baker et al., 2018; BLS, 1995; Church et al., 2011; Dembe, Erickson, Delbos, & Banks, 2005; Dempsey et al., 2016; Dunstan et al., 2013; Karakolis, Barrett, & Callaghan, 2016; National Safety Council [NSC], 2018a; NSC, 2018b; Mehrprarvar et al., 2014; Tuchsen, Hannerz, Burr, & Krause, 2005; NIOSH, 2018; Wilmot et al., 2012).

Program Description

The initial phase of this workshop (pilot study) is designed in a shortened format (20 minutes). This length was purposefully selected to increase the likelihood of physician participating. Although Occupational Medicine (OM) physicians receive in depth training and education in ergonomics and ergonomic risk factors, the Institute of Medicine (IOM) states that there is a national shortage of occupational and environmental medicine physicians, making their presence in primary care and educational settings less typical (Castorina & Rosenstock, 1990). For this reason, primary care physicians were the targeted audience as it is reasonable to surmise that with the high rate of MSD and Type Two Diabetes Mellitus (T2DM) in the United States, that primary care physicians' may encounter these issues in a segment of their patient population (CDC, 2018a; Michas & Iacono, 2006; NSC, 2018a; NSC, 2018b).

In addition to a thorough outline of occupational risks to commonly seen health issues, the discussion of how physicians can best integrate evidence-based screening questions and a decision tree into their patient treatment sessions will be included. As

evidence-based research suggests that physicians have less understanding of OT's role when compared to other disciplines, it is important that the workshop uses the language as it relates to preventative health and primary care from the American Occupational Therapy Association's (AOTA) Occupational Therapy Practice Framework (AOTA, 2014; Halle, Mroz, Fogelberg, & Leland, 2018; (Donnelly, Brenchley, Crawford, & Letts, 2013). It is anticipated that physicians' time constraints and lack of interest in OM may make information translation a challenge (Yarnall et al., 2003; Michas & Iacono, 2006; Russ et al., 2012). It is for this reason, a portion of the workshop will acknowledge the time constraints faced by physicians and explain OT's scope of practice to encourage patient referrals, with the intention of making ergonomic education/training appear more reasonable (Yarnall et. al., 2003; AOTA, 2014).

Program Evaluation and Dissemination

Based on a study of medical student education that utilized Mayer's Cognitive Theory of Multimedia Learning, the evaluation of the pilot study will administer a pre-test, immediate post-test, and two additional post-tests at one- and four- weeks following workshop participation (Issa et al., 2013). It is through the analysis of the survey results that information retention and translation can be determined. The results can then be disseminated to advocate for the value of the program. The dissemination will include an audience of physicians, medical facilities, and medical education institutions.

Implications

Physicians and Medical Education Institutions

The information provided in this workshop highlights the need for increased

occupational medicine education, specifically ergonomics, in medical school curriculum. This is important not only for the benefit of the physician so that they are prepared to recognize and treat MSD and other health risks associated with occupational hazards, but to also ensure adequate health related quality of life for the patient. If the information presented in this workshop is deemed valuable, medical facilities and medical education institutions may be encouraged to integrate this information into medical education curriculum.

Occupational Therapy

With time constraints being a barrier to the incorporation of ergonomic training in primary care and the utilizing of occupational therapy practitioners as care extenders, it is important that occupational therapy practitioners feel empowered and confident to deliver this training. Occupational therapy practitioners will need to be well-versed in current evidence-based research on the topic of ergonomics beyond the basics of proper body mechanics. As the evidence-based literature regarding the risks of prolonged sitting and standing expands, so must the intervention and education approach of occupational therapy practitioners. Comprehensive education and training session in ergonomics might include: evaluation and treatment of inhibited and overactive musculature, recommendations for appropriate sit-stand ratio times, proper standing desk height recommendations, patient specific recommendations for frequency of movement and integration of appropriate stretches, and the application of the before mentioned topics to settings outside of work.

It is anticipated that following participating in the *Physicians' Role in Patient*

Ergonomics workshop, physicians will deem the information presented of value to their patient population. This would encourage physicians to integrate screening questions and ergonomic considerations into their patient POC and make referrals to occupational therapy for ergonomic education and training, resulting in greater understanding of occupational risk exposure and reduction by patients.

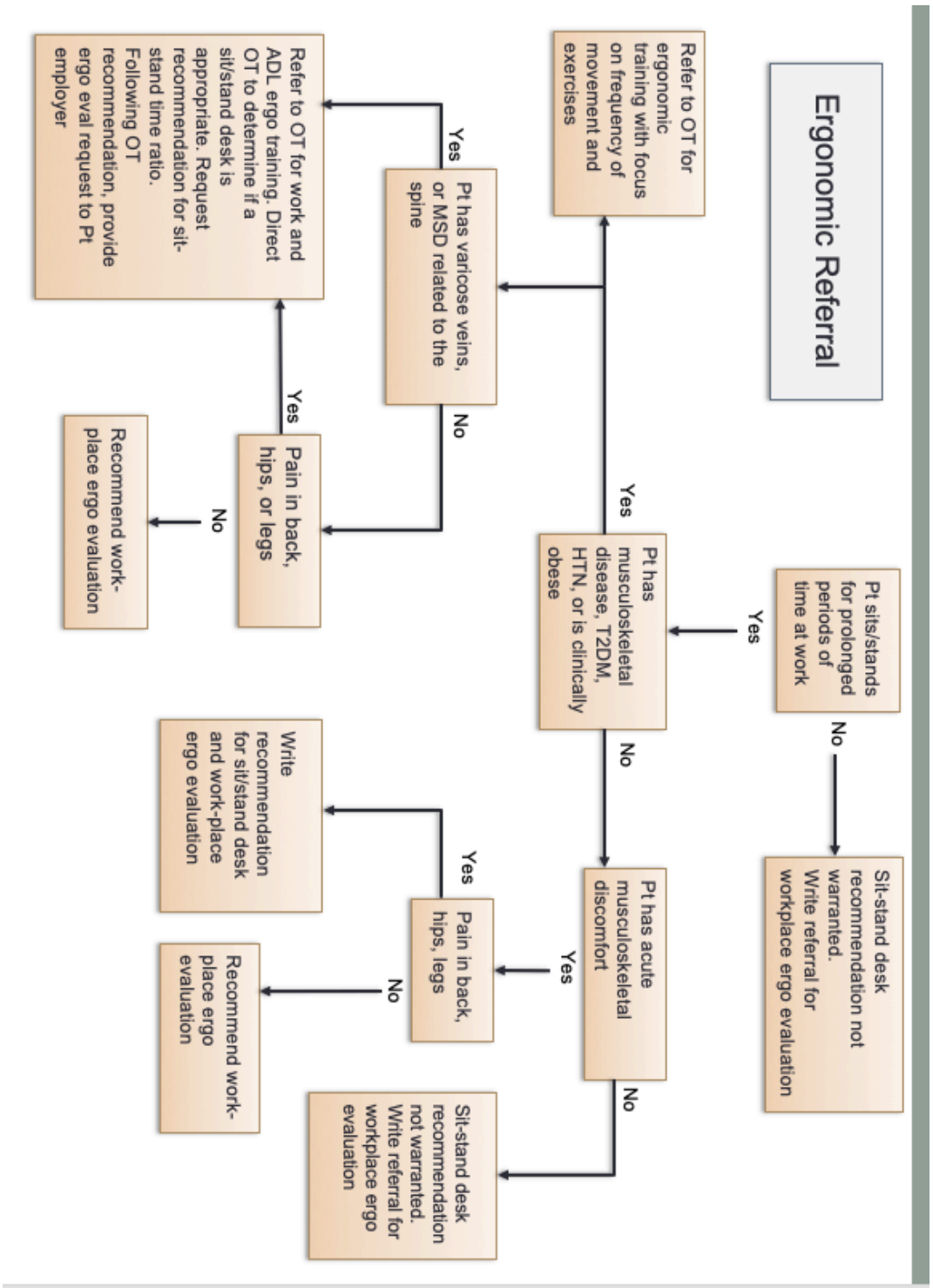
APPENDIX A- Screening Questions

Patient Occupational-Risk Screening Questions

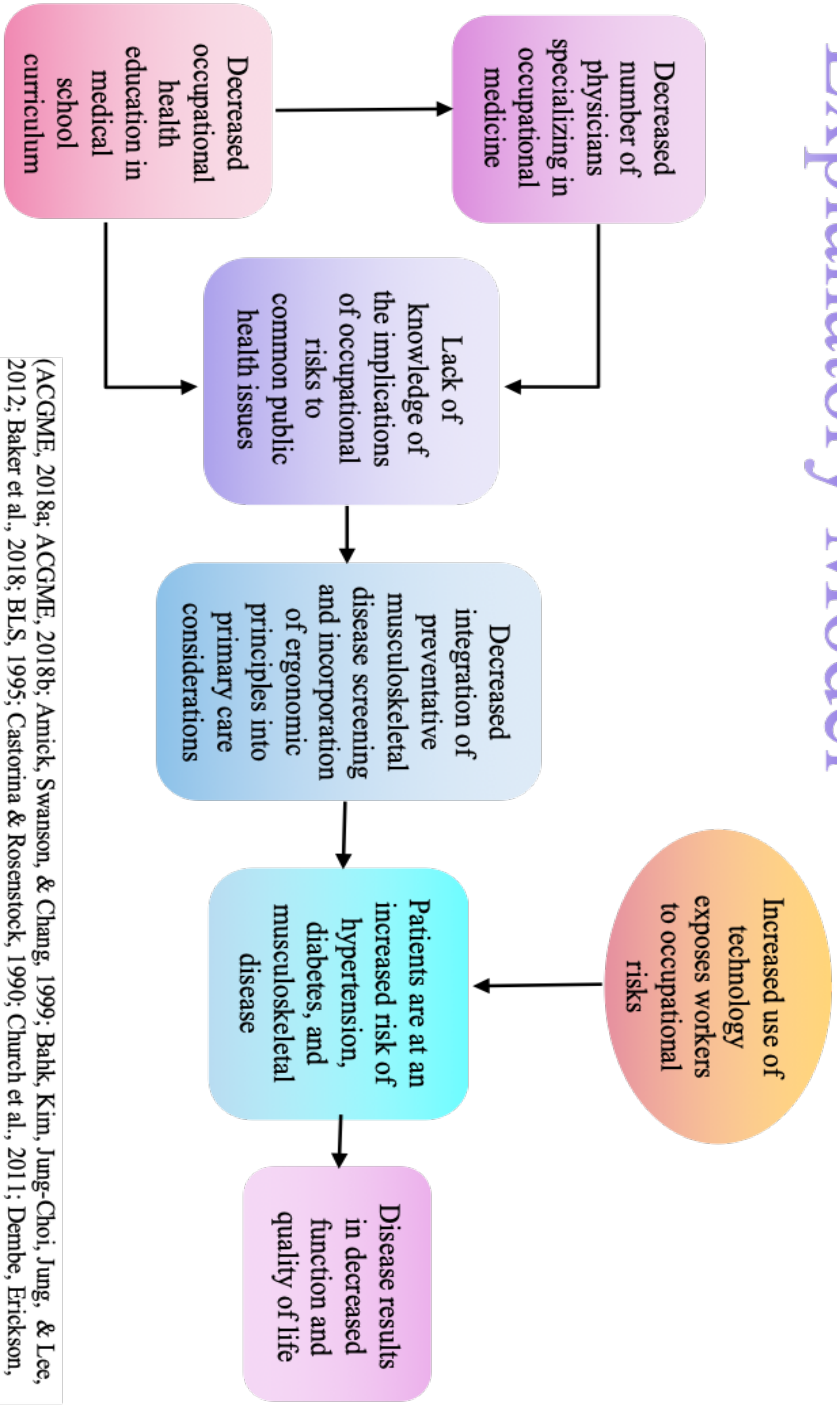
○	Does the patient have a history of diabetes?
○	Does the patient have a history of hypertension?
○	Does the patient have a history of musculoskeletal disease?
○	Is the patient experiencing acute discomfort?
○	Is the patient currently working?
○	Does the patient sit or standing for prolonged periods of time throughout the day?

***If you answered yes to three or more of these questions, patient may benefit from ergonomic education/training. Utilize decision tree to clarify referral source.

APPENDIX B- Decision Tree



APPENDIX C- Explanatory Model



(ACGME, 2018a; ACGME, 2018b; Amick, Swanson, & Chang, 1999; Bahk, Kim, Jung-Choi, Jung, & Lee, 2012; Baker et al., 2018; BLS, 1995; Castorina & Rosenstock, 1990; Church et al., 2011; Dembe, Erickson, Delbos, & Banks, 2005; Dempsey et al., 2016; Dunstan et al., 2013; Karakolis, Barrett, & Callaghan, 2016; NSC, 2018a; NSC, 2018b; Mehrparvar et al., 2014; Michas & Iacono, 2008 Tissot F, Messing, & Stock, 2009; Tuchsen, Hannerz, Burr, & Krause, 2005; NIOSH, 2018; Wilmot et al., 2012)

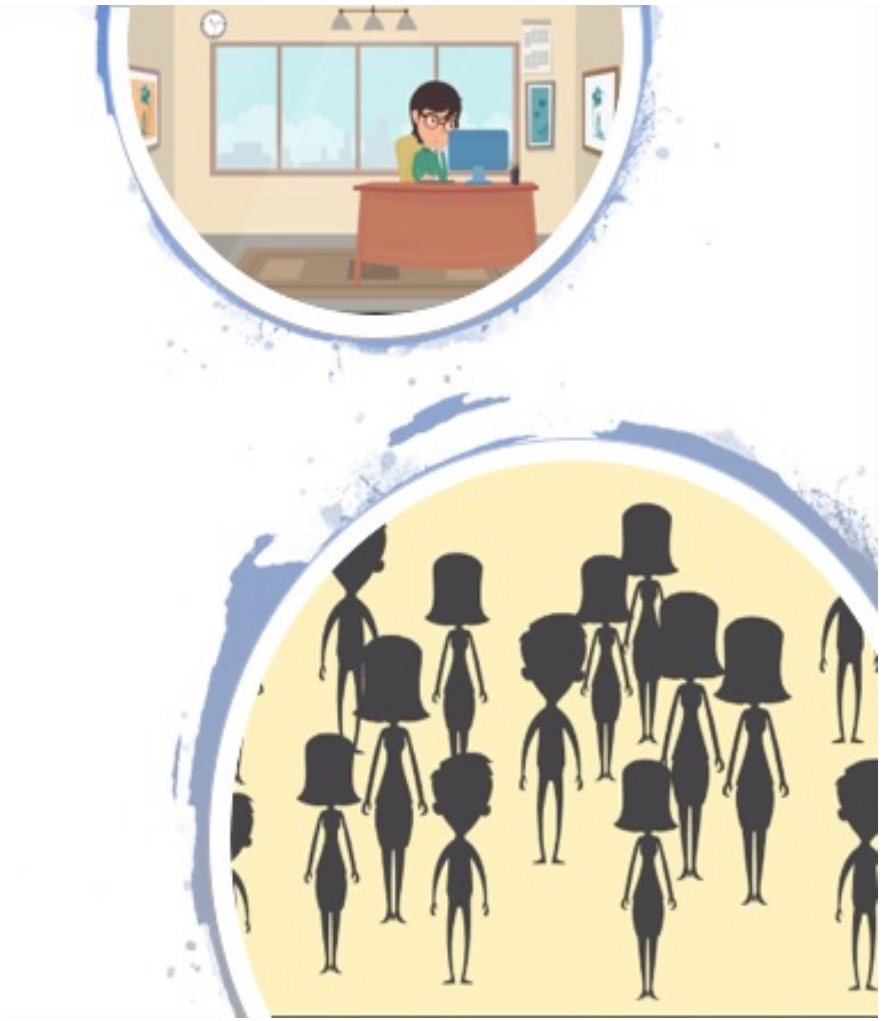
APPENDIX D- physicians' Role in Patient Ergonomics Workshop

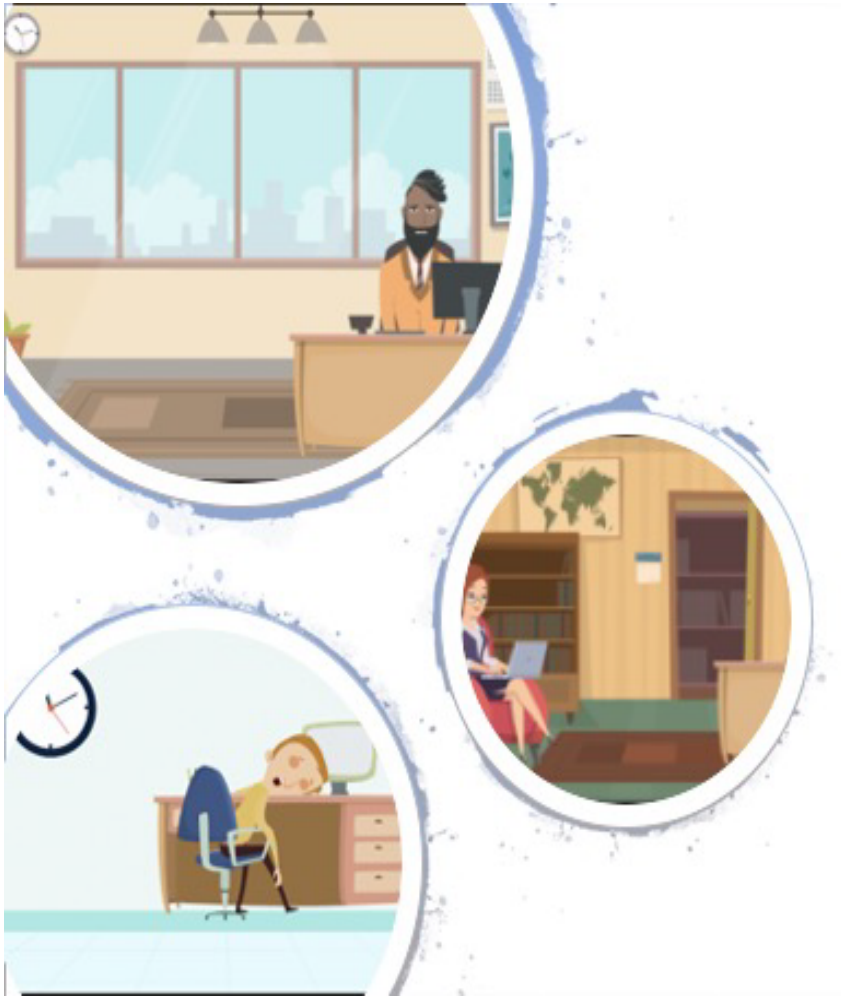
The Physicians' Role in Patient Ergonomics Workshop

Allison Mula, OTD, OTR/L, CEAS

Work Trends

Occupational physical activity trend analysis indicates that occupations that once required more intensive physical activity have evolved into occupations that require much less physical activity, resulting in increased sedentary time (Church et al., 2011; Dunstan et al., 2013).





With the ever increasing rate of the integration of technology, and office workers making up the largest single sector of occupations, many workers are spending an increasingly large portion of their work time in the prolonged sitting or standing position and working on computer based systems (Healy et al., 2016; Thorp et al., 2012; Church et al., 2011; Dunstan et al., 2013; Amick et al., 1999; BLS, 2005; NIOSH, 1999).

In a study by Healy et al. (2016), office workers were found to sit, stand, and step for, "78.8% ± 9.5%, 14.3% ± 8.2%, and 6.9% ± 2.9% of work hours, respectively" (p. 1787).

Evidence

Evidence-based research suggests that increased sedentary time is associated with diabetes, and other mortality causing diseases such as cardiovascular disease (Wilmot et al., 2014).

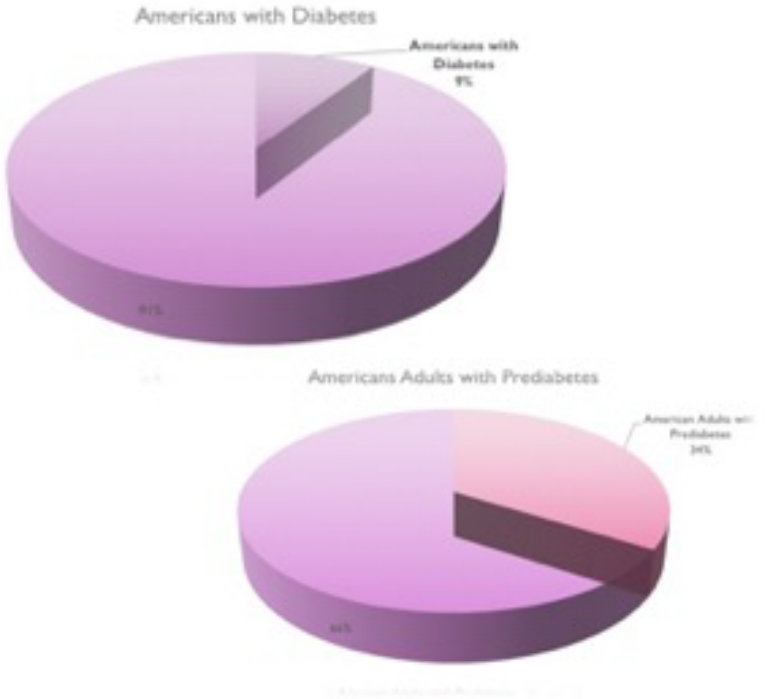
Research suggests that time spent in prolonged sitting and standing, awkward postures, and repetitive movements has a deleterious effect on the musculoskeletal and physiological systems of the human body and is associated with diabetes, and other mortality causing diseases such as cardiovascular disease

(Amick, Swanson, & Chang, 1999; Bahk, Kim, Jung-Choi, Jung, & Lee, 2012; Baker et al., 2018; BLS, 1995; Church et al., 2011; Dembe, Erickson, Delbos, & Banks, 2005; Dempsey et al., 2016; Dunstan et al., 2013; Karakolis, Barrett, & Callaghan, 2016; National Safety Council [NSC], 2018a; NSC, 2018b; Mehrparvar et al., 2014; Tissot F, Messing, & Stock, 2009; Tuchsen, Hannerz, Burr, & Krause, 2005; NIOSH, 2018; Wilmot et al., 2012).

Diabetes

A recent CDC (2018), report on the prevalence of diabetes in the united states suggests that 9.4% of the US population, which is 30.3 million people, have diabetes.

The CDC goes on to provide statistics for pre-diabetes which shows that 33.9% of the adult US population are pre-diabetic, which is 84.1 million adults 18 years or older.



CDC, 2017

Hypertension

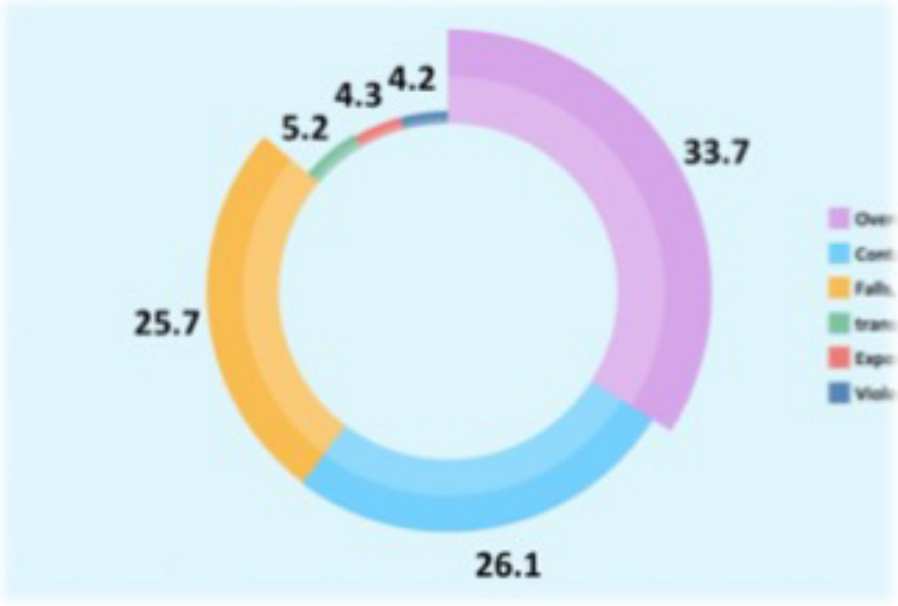
The CDC (2017) suggests, that 33.2% of adults aged 20 and over have hypertension. Studies have shown the negative impact of sedentary behavior on individuals with diabetes and hypertension, making this population more vulnerable to exposure to occupational risk factors (Wilmot et al., 2003; Dempsy et al., 2016).

Musculoskeletal Disease

It is estimated that 25% of total workers compensation costs, which is approximately $15.1 billion a year, will be due to workplace overexertion (NSC, 2018a; NIOSH, 2018).

The top work-related injury cause reported by the NSC (2018b), is overexertion and bodily reaction which makes up 33.7% of all non-fatal work-related injuries.

Overexertion is classified as excessive physical effort while in contact with objects and equipment, and includes non-impact related injury (lifting, pushing, carrying), and repetitive motion injuries, which are described as microtasks resulting in strain due to repetitive movements (NSC, 2018b).



Ergonomic Principles

Before we being to talk about the current public health issues and their relationship to ergonomic principles, let us briefly discuss what a few basic ergonomic principles are

- Maintain neutral and supported body positions
- Reduce small repetitive movements during work tasks
- And change position frequently

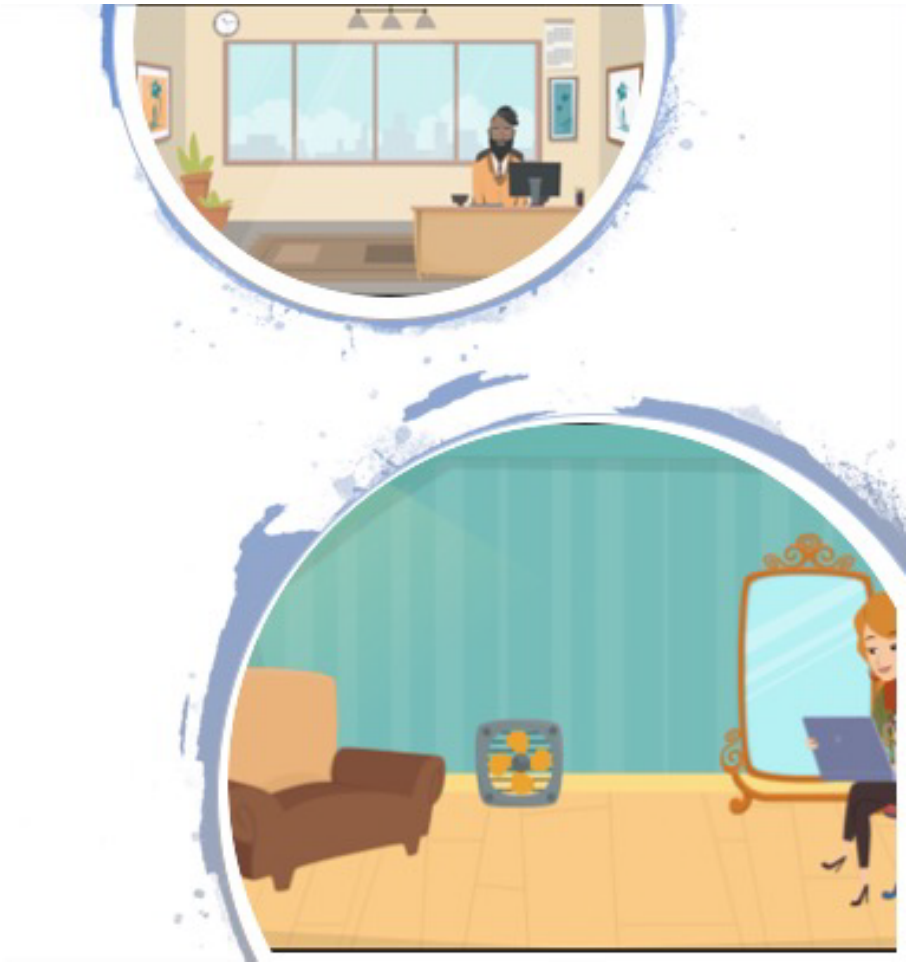
How Does it All Connect?

You may be thinking, this is all interesting but how does this connect to ergonomics?

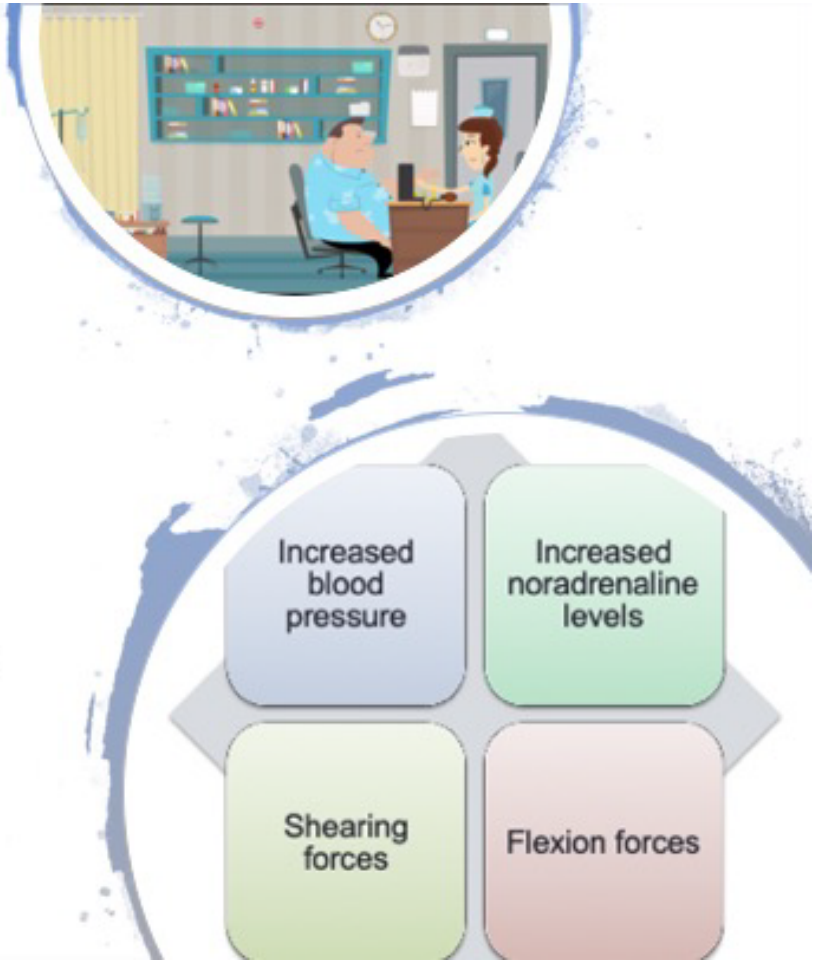
Let us look at what we know about prolonged sitting and standing, and the musculoskeletal and physiological effects.

Prolonged Sitting

- Prolonged sitting during work tasks has been linked to low back, shown to increase intradiscal pressures, and can to lead to disc herniation (Karakolis, Barrett, & Callaghan, 2014).
- Karakolis et al. (2014), showed that there was an increased occurrence of spinal flexion (a known mechanism of injury) when workers were seated for prolonged periods of time.

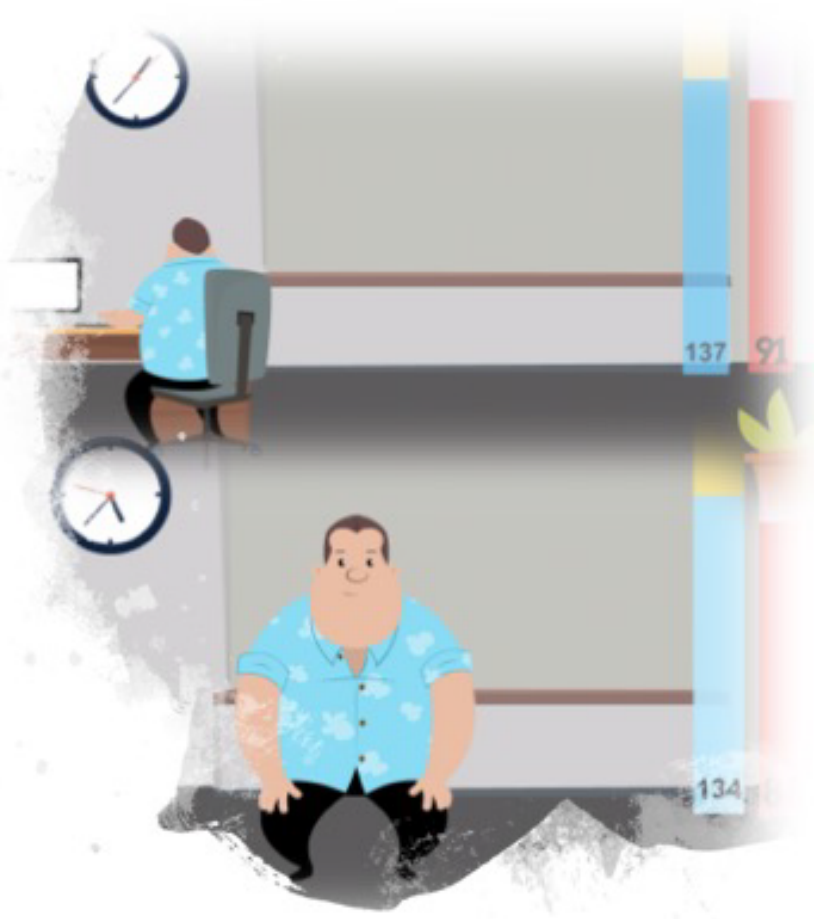


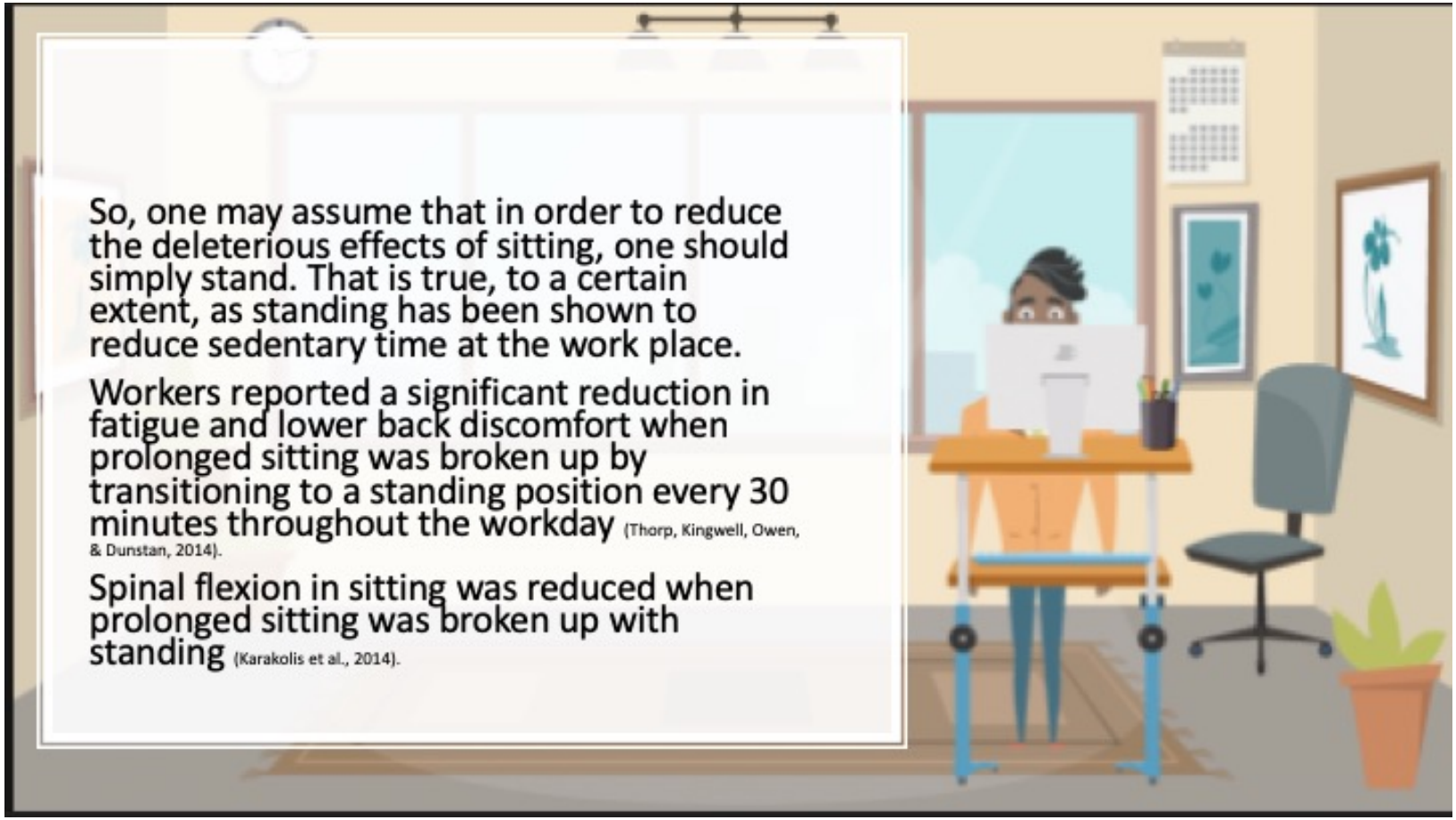
- It has been found that much of work sedentary time is accumulated in long bouts of sitting (at least 20-30 minutes). The literature suggests that the total sedentary time and the manner in which this total time is achieved is related to T2DM, cardiovascular disease, hypertension, some types of cancer, and early mortality (Dunstan et al., 2013; Dempsy et al., 2016; Wilmot et al., 2012).
- Multiple studies note that the workplace has been identified as a key setting in which intervention to reduce sitting time would be beneficial (Healy et al., 2016; Thorp et al, 2012).



Dempsy et al., 2016 Study

- Dempsy et al. (2016), showed elevation of blood pressure and noradrenaline levels in individuals with T2DM with the occurrence of prolonged sitting during the work day. When prolonged sitting was broken up every 30-minutes throughout the day with bouts of simple resistive activities or light walking, workers showed a decrease in both blood pressure and noradrenaline levels.
- When prolonged sitting was broken up with light resistive exercises performed for a total of 3 minutes both BP and noradrenaline levels were reduced. (Calf-raises, half-squats, and knee raises) performed 20 seconds each, three times.




So, one may assume that in order to reduce the deleterious effects of sitting, one should simply stand. That is true, to a certain extent, as standing has been shown to reduce sedentary time at the work place.
Workers reported a significant reduction in fatigue and lower back discomfort when prolonged sitting was broken up by transitioning to a standing position every 30 minutes throughout the workday (Thorp, Kingwell, Owen, & Dunstan, 2014).
Spinal flexion in sitting was reduced when prolonged sitting was broken up with standing (Karakolis et al., 2014).

Standing

However, the literature shows that prolonged standing can have negative effects like,

- Decreased cognition
- Decreased productivity
- Increased risk of varicose veins and nocturnal leg cramps
- Increased risk of hospitalization due to varicose veins
- Increased extension forces on the spine

Annick, Swanson, & Chang, 1999; Bahk, Kim, Jung-Choi, Jung, & Lee, 2012; Baker et al., 2018; BLS, 1995; Church et al., 2011; Dembe, Erickson, Delbos, & Banks, 2005; Dempsey et al., 2016; Duarte et al., 2013; Karakolis, Barrett, & Callaghan, 2006; National Safety Council [NSC], 2018a; NSC, 2018b; Mehrparvar et al., 2014; Tissot F. Messing, & Stock, 2009; Tuchsen, Hannerz, Burr, & Krause, 2005; NIOSH, 2018; Wilmot et al., 2012)

Workers with occupational tasks requiring prolonged standing showed an increase in the occurrence of varicose veins and nocturnal leg cramps, and an increased risk of hospitalization secondary to varicose veins (Bahk, Kim, Jung-Choi, Jung, & Lee, 2012; Tuchsen, Hannerz, Burr, & Kraus, 2015;).

Standing

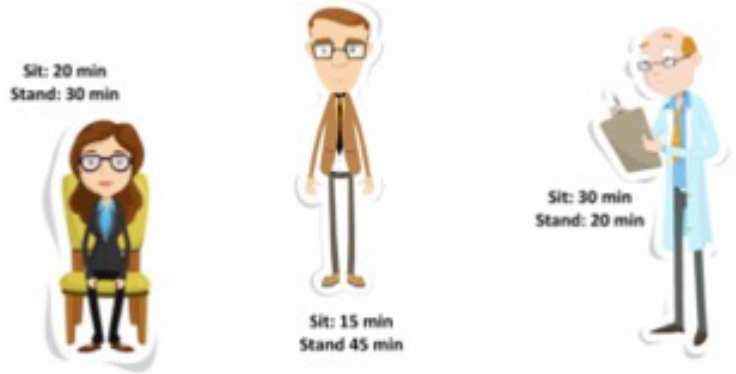
- Baker et al., 2018 discusses the impact of standing on musculoskeletal, circulatory, and cognitive function.
- Prolonged standing showed increased discomfort in all areas of the body (most significant in lower limb and lower body), reaction time and mental state decreased (Baker et al., 2018).

Standing Desks

Because the research suggest that prolonged standing can also be detrimental. It is important to consider the implications of standing option desk recommendation. Without proper training patients could be unknowingly increasing their occupational risk exposure.

Sit-stand time ratios vary depending on gender, body mass, and past medical history. Patients' with sit-stand desks should receive proper training to reduce the before mentioned risks.

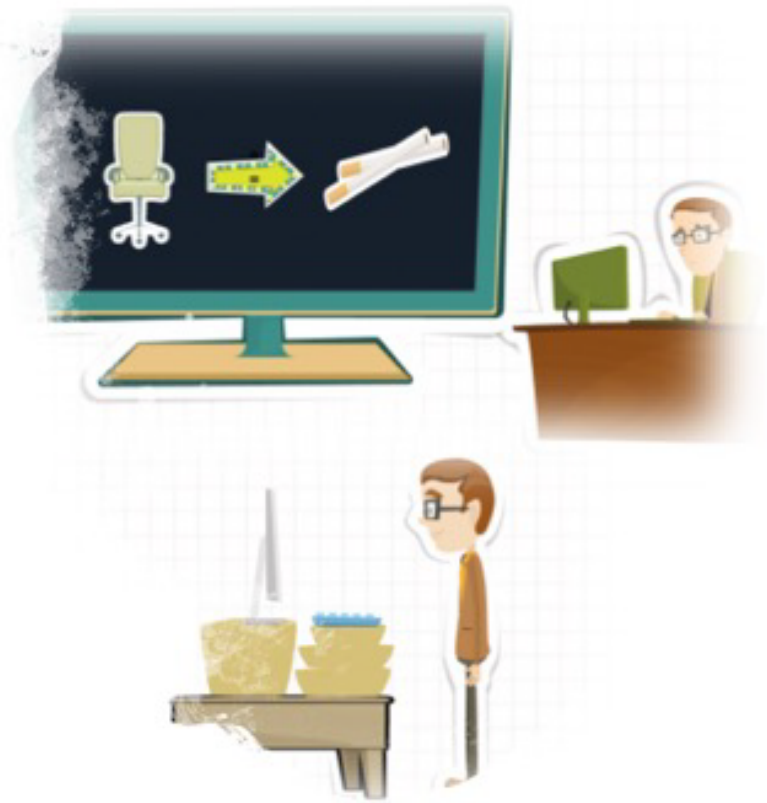
Individualized Sit/Stand Ratio



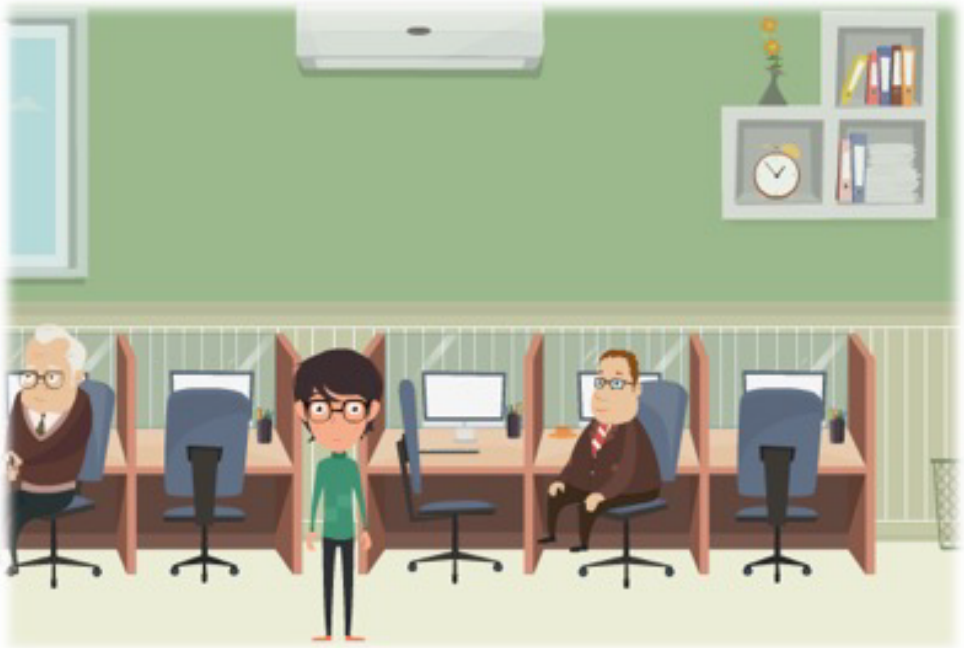
Standing Desks

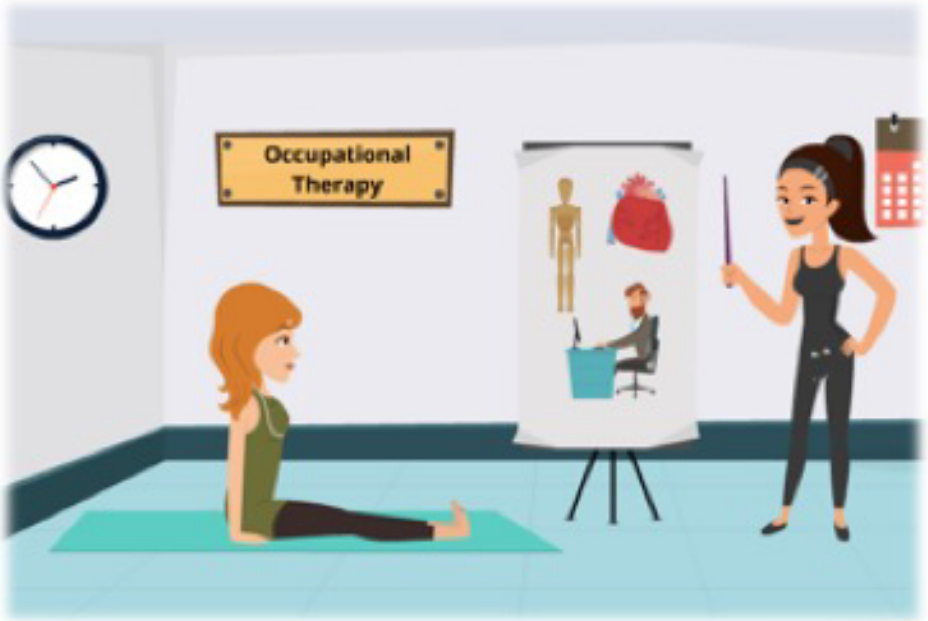
Because of the increase of fear based advertising, patients have began to do what they can to reduce their sitting time at work. This includes creating their own sit-stand desks, and standing for prolonged periods of time throughout the day.

Proper training and education would reduce this risk while still meeting the patients desire to take an active role in their health and wellness.



When we consider the impact of MSD, hypertension, and diabetes and their correlation with occupational risk factors, we can surmise based on the prevalence of diabetes, hypertension, and MSD, that the connection between sedentary behavior and overall health and wellness of the US population needs to be taken seriously, especially with the rising concern of healthcare costs in the United States.





As the impact of the aforementioned health risks associated with exposure to ergonomic risk factors is great, it is important that patients begin to receive proper ergonomic training. Training patient's in ergonomic principles that are tailored to their specific needs and current health limitations may also encourage patients to take a role in their own health and wellness.

According to the institute of medicine (IOM) there is a national shortage of occupational and environmental medicine physicians

(Castorina & Rosenstock, 1990; McAdams, Kerwin, Olivo, & Goksel, 2011).

Why This Matters…

The shortage of available physicians specialized in OM not only reduces the available faculty in medical schools and presence in the primary care setting, but also reduces available public health physicians in state and local agencies

Because of the shortage of OM specialists, it is increasingly important that primary care physicians are trained to screen and care for patients with occupational injuries

Current Barriers

- Time constraints may affect physician's willingness and ability to incorporate ergonomic screening into primary care office visits.
- With an exorbitant amount of preventative screening already required by physicians, additional preventative screening may be considered unreasonable

(Yarnall, Pollak, Ostbye, Krause, & Michener, 2003).

It would require 7.4 hours per working day of preventative screening to comply with the already existing preventative screening recommendations, making it seem unreasonable to integrate additional screening (Yarnall et al., 2003).

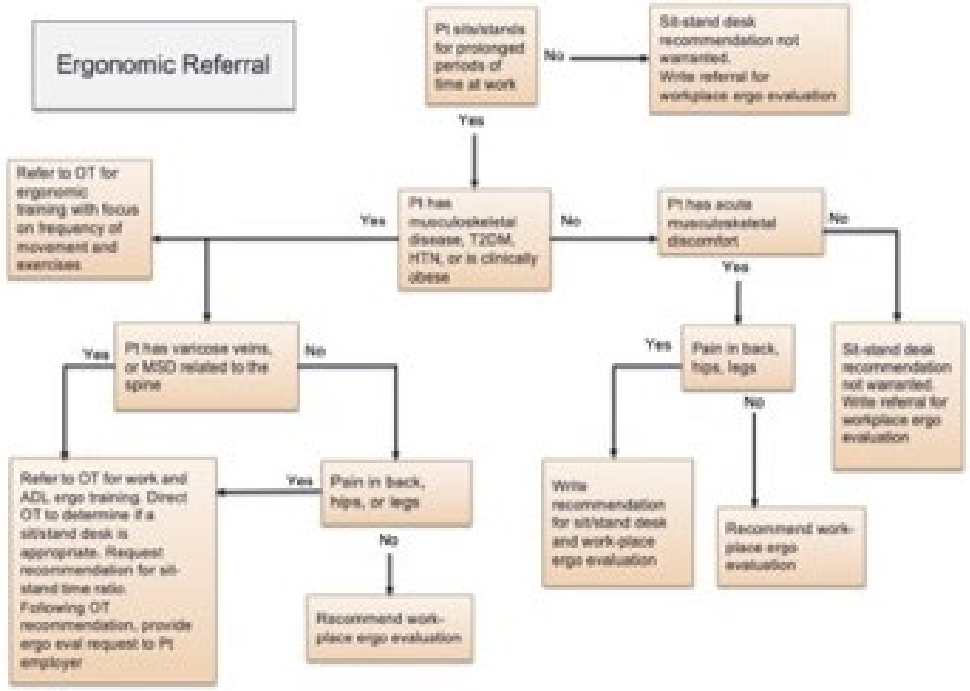
The addition of even small interventions adds significantly to the physicians' workload when applied to a large population and that any new screening may be performed at the expense of some other service already provided (Yarnall et al., 2003).

Screening Questions

An Efficient and reasonable way to screen patients for occupational risk exposure is through the utilization of brief screening questions. Some that are already included when obtaining the patients past medical history.

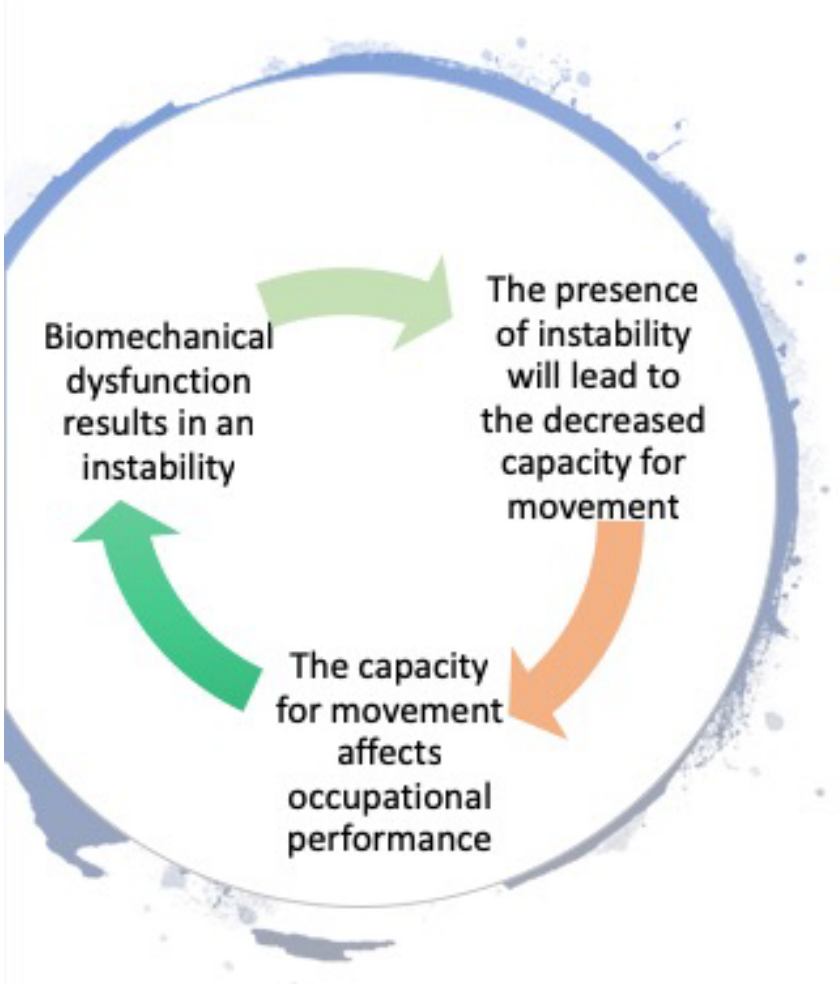
Decision Tree

The decision tree can be utilized as an efficient way to determine the ideal referral source for patients that have been flagged for occupational risk exposure.



In the national assessment of the occupational safety and health workforce report it is recommended that in order to compensate for the lack of physicians specialized in occupational medicine, that other disciplines are referred to for patient education and training (McAdams et al., 2011).

Occupational therapy can be this referral source.



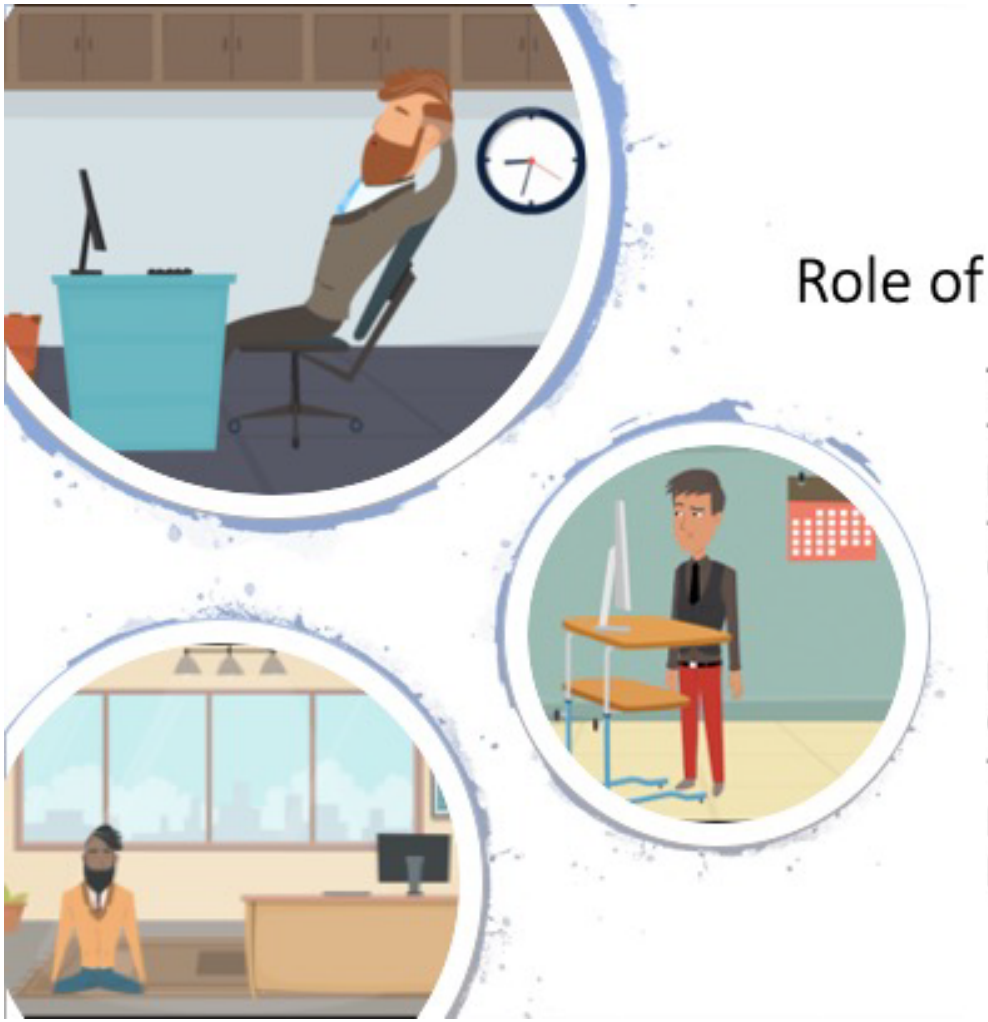
How This Connects to Occupational Therapy

The biomechanical model addresses maintaining biomechanical capacity, as the capacity for movement affects occupational performance

When biomechanical dysfunction originating from injury or disease is present, there will be a resulting instability, the presence of instability will lead to the decreased ability to efficiently participate in daily occupations

It is within this model that the connection of MSD and other health issues to decreased occupational performance can be made.

(Kielhofner, 2009).



Role of Occupational Therapy

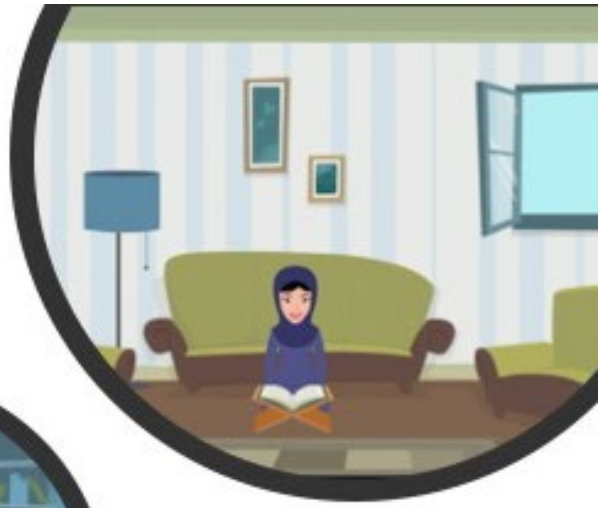
The term occupation is any task that occupies an individual's daily life and contributes to the formulation of their self-concept (Kielhofner, 2009).

By this definition, work and a person's ability to effectively and efficiently perform their work tasks, falls into the scope of practice for occupational therapy practitioners.

Occupational therapy practitioner's extensive knowledge-base in task analysis allows for training in all areas of activities of daily living, not limited to the work setting.

It is recognized within the framework of occupational therapy that an individual's ability to perform and engage in meaning occupations play a large role in an individual's self-concept (AOTA, 2014; Kielhofner, 2009).

By understanding the importance of occupation to health and well-being, recognizing the challenges/potential risks to the completion of occupations, and understanding disease causation and process, occupational therapy practitioners can counsel/problem solve, modify environments, and provide necessary technical devices to optimize occupational performance (Kielhofner, 2009).



Occupational therapy training may include:

- Interview to determine patient's occupational requirements
- Evaluation and treatment of inhibited and overactive muscles
- Recommendations for appropriate sit-stand ratio times
- Proper standing desk height recommendations
- Patient specific recommendations for frequency of movement
- Individual specific stretches

Ergonomic Training

MAKE THE CONNECTION BETWEEN OCCUPATIONAL RISKS AND COMMON HEALTH ISSUES

INTEGRATE SCREENING QUESTIONS AND DECISION TREE FOR TIME EFFICIENCY

UTILIZE OT AS A MEMBER OF THE PRIMARY CARE TEAM

Recommendations

It is anticipated that following participation in the Physicians' Role in Patient Ergonomics workshop, that physicians will begin to integrate screening questions and the decision tree into the patient plan of care.

The utilization of these how-to materials and view of occupational therapy practitioners as a part of the primary care team, will reduce the perceived burden of additional preventative screening and increase the feasibility of integrating ergonomics into primary care patient POC considerations.

APPENDIX E- Recruitment Flyer

The Physicians' Role in Patient Ergonomics Workshop

Seeking physicians practicing in primary care to participate in a pilot study aimed at investigating if physician participation in a brief online ergonomic workshop, will result in the in integration of occupational risk screening into primary care.

It's time to talk about the recent research on the deleterious effects of prolonged sitting and standing, awkward postures, and repetitive movements on your patient's overall health and wellness.

The virtual 20-minute workshop will include

- A discussion of how common diabetes, hypertension, and musculoskeletal disease are correlated with occupational risks.
- The role physicians can play in ergonomic education
- How-to materials to efficiently incorporate ergonomic screening and determine appropriate referral sources for patient training and education.

What is required from you?

- Participation in 20-minute virtual workshop (completed online)
- Completion of online pre- and post-test

APPENDIX F- Consent Form

What the study is about: The purpose of this study is to Determine if a workshop on ergonomics created for physicians will result in information retention on ergonomic principles and translate into physicians increased ergonomic considerations in patient plan of care (POC).

What we will ask you to do: If you agree to be in this study, we will ask you to complete a pre-test consisting of 5 multiple choice questions and one Likert scale style question. You will then take part in an online workshop on ergonomic principles and the risks of prolonged sitting and standing, repetitive movements, and awkward postures. The workshop will take approximately 20 minutes to complete. You will then be issued a questionnaire to assess immediate retention of information and applicability to current practice population. We will send an additional questionnaire to assess delayed retention and any noted change in practice that may have resulted from taking part in the workshop. These post-tests will be sent at one- and four- weeks after the workshop. Each test will take 5-10 minutes to complete.

Risks and benefits: The main risk of allowing us to use and store your information for research is a potential loss of privacy. I will protect your privacy by labeling your information with a code and keeping the key to the code in a password-protected computer. There are no direct benefits from participating in this study, but you may gain knowledge on a public health issue that could be addressed through your practice as a physician.

Compensation: There will be no compensation for participating in the study.

Your answers will be confidential. The records of this study will be kept private. In any sort of report, we make public we will not include any information that will make it possible to identify you. Only the researchers will have access to the records.

Taking part is voluntary: Taking part in this study is completely voluntary. You may skip any questions that you do not want to answer. If you decide not to take part or to skip some of the questions, it will not affect your current or future relationship with Boston University. If you decide to take part, you are free to withdraw at any time.

If you have questions: The researchers conducting this study are Allison Mula, student at Boston University, and Dr. Karen Jacobs. Please ask any questions you have now. If you have questions later, you may contact Allison Mula at amula@bu.edu or at 716-969-5281. If you have any questions or concerns regarding your rights as a subject in this study, you may contact the Institutional Review Board (IRB) at 617-358-6115 or access their website: https://www.bu.edu/researchsupport/profile/institutional-review-board-irb/ You will be given a copy of this form to keep for your records.

Statement of Consent: I have read the above information and have received answers to any questions I asked. I consent to take part in the study.

Area of Practice:_____Email: _____

This consent form will be kept by the researcher for at least three years beyond the end of the study.

Allison Mula, MS, OTR/L, CEAS

Student, On-line Post-Professional Doctorate in Occupational Therapy
Boston University
College of Health & Rehabilitation Sciences: Sargent College
amula@bu.edu
716-969-5281 (mobile)

Karen Jacobs, Ed.D., OT, OTR, CPE, FAOTA
Clinical Professor
Program Director, On-line Post-Professional Doctorate in Occupational Therapy
Boston University
College of Health & Rehabilitation Sciences: Sargent College
Department of Occupational Therapy
635 Commonwealth Ave.
Room 511A
Boston, MA 02215 USA
617 353-7516 (office) 617 838-1872 (mobile)
kjacobs@bu.edu

APPENDIX G- Initial Email

Dear potential participant,

My name is Allison Mula and I am currently a graduate student of the on-line post-professional doctorate in occupational therapy (OTD) program at Boston University's Sargent College of Health and Rehabilitation Sciences. Thank you for considering participating in a pilot study aimed at investigating if physician participation in an ergonomic workshop will result in gained knowledge and information retention/translation, resulting in integration of ergonomics into patient plan of care.

This workshop highlights the recent research on the risks of, lack of quality movement, prolonged sitting and standing, and repetitive movements on your patient's overall health and wellness. It will also discuss current trends in ergonomics, existing limitations, and possible solutions to these limitations. The video viewing and pre/post tests will take place in an online format. It will be a prerecorded workshop and will not require your interaction at the time of viewing.

If you do decide to take part in this workshop, please reply to this email (or to amula@bu.edu) and send the completed attached consent form that describes the workshop and expectations for your participation. Following your agreement to participate and acknowledgment of the consent form, on the targeted start date, you will receive an email with a link to a brief pre-test/survey to determine your current level of knowledge regarding this subject. Following completion of this pre-test/survey, you will be given access to an online workshop that will be ~10-15 minutes in length.

The target start date of the pilot study will be the second week in April 2018. This will be confirmed in a follow-up email once our goal number of participants has been attained. Following the workshop (video viewing), you will complete a brief post-test/survey. You will be asked to complete the post-test/survey again at one- and three-weeks post-workshop to determine information retention. If you have any questions, please feel free to reach out by simply replying to this email or by utilizing one of the methods of contact below.

Sincerely,

Allison Mula, MS, OTR/L, CEAS
Student, On-line Post-Professional Doctorate in Occupational Therapy
Boston University
College of Health & Rehabilitation Sciences: Sargent College
amula@bu.edu
716-969-5281 (mobile)

Karen Jacobs, Ed.D., OT, OTR, CPE, FAOTA
Clinical Professor
Program Director, On-line Post-Professional Doctorate in Occupational Therapy
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635 Commonwealth Ave.
Room 511A
Boston, MA 02215 USA
617 353-7516 (office) 617 838-1872 (mobile)
kjacobs@bu.edu

APPENDIX H- Follow-Up Email Confirmed Participant

Dear Participant,

We have received your email confirming your agreement to participate in this pilot study, and acknowledgement of the consent form. Included in this email is a link to a pre-test/survey. Once you have completed and submitted the survey you will be receive an email with a link to the online ergonomic workshop. Following the workshop, you will be directed to a post-test/survey. We appreciate your participation. If you have any questions, please feel free to reach out by simply replying to this email or by utilizing one of the methods of contact below.

Sincerely,

Allison Mula, MS, OTR/L, CEAS
Student, On-line Post-professional Doctorate in Occupational Therapy
Boston University
College of Health & Rehabilitation Sciences: Sargent College
amula@bu.edu
716-969-5281 (mobile)

Karen Jacobs, Ed.D., OT, OTR, CPE, FAOTA
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Room 511A
Boston, MA 02215 USA
617 353-7516 (office) 617 838-1872 (mobile)
kjacobs@bu.edu

APPENDIX I- Follow-Up Email One-Week Post-Workshop

Dear participant,

Thank you for participating in the online workshop. We have received your initial post-test/survey that was completed following the completion of the workshop. In this email, you will find a link to the three-week post-workshop test/survey. Please follow this link at your earliest convenience and complete. If you have any questions, please feel free to reach out by simply replying to this email or by utilizing one of the methods of contact below.

Allison Mula, MS, OTR/L, CEAS
Student, On-line Post-professional Doctorate in Occupational Therapy
Boston University
College of Health & Rehabilitation Sciences: Sargent College
amula@bu.edu
716-969-5281 (mobile)

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kjacobs@bu.edu

APPENDIX J- Follow-Up Email Four-Week Post-Workshop

Dear participant,

Thank you for participating in the online workshop. We have received your 3-week post-test/survey. In this email, you will find a link to the three-week post-workshop test/survey. Please follow this link at your earliest convenience and complete. If you have any questions, please feel free to reach out by simply replying to this email or by utilizing one of the methods of contact below.

Sincerely,

Allison Mula, MS, OTR/L, CEAS
Student, On-line Post-professional Doctorate in Occupational Therapy
Boston University
College of Health & Rehabilitation Sciences: Sargent College
amula@bu.edu
716-969-5281 (mobile)

Karen Jacobs, Ed.D., OT, OTR, CPE, FAOTA
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Program Director, On-line Post-professional Doctorate in Occupational Therapy
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Boston, MA 02215 USA
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kjacobs@bu.edu

APPENDIX K- Pre-Test Questionnaire

1) **Prolonged sitting effects which body systems?**
    1. Musculoskeletal
    2. Cardiovascular
    3. Endocrine
    4. **All off the above**
2) **What is the result of interrupting prolonged sitting with brief bouts of light-intensity walking or Simple Resistance Activities?**
    1. Increased resting BP and in adults with T2D
    2. Increased plasma noradrenaline in adults with T2D
    3. **Reduced plasma noradrenaline in adults with T2D**
    4. None of the above
3) **What diagnosis is affected by prolonged standing?**
    1. Spinal Stenosis
    2. Spondylolisthesis
    3. Hypertension
    4. **All of the above**
4) **What information should be considered when making recommendations for sitting and standing time ratios?**
    1. Patient's cardiovascular health
    2. Patient's body mass
    3. Patient's tolerance for spinal flexion and extension
    4. **All of the above**

5) **What is the optimal referral source for patient ergonomic training that will address aspects of behavioral health, physical rehabilitation, environmental modification, and disease process?**

1. **Occupational therapy practitioner**
2. Patient employer
3. Patient online resources
4. Athletic trainer

6) **How often do you currently include ergonomic considerations into patients' plan of care?**

0	1	2	3	4
Never	**Rarely**	**Occasionally**	**Often**	**All the time**

APPENDIX L- Post-Test Immediate Retention Questionnaire

1) Prolonged sitting effects which body systems?

1. Musculoskeletal
2. Cardiovascular
3. Endocrine
4. **All of the above**

2) What is the result of interrupting prolonged sitting with brief bouts of light-intensity walking or Simple Resistance Activities?

1. Increased resting BP and in adults with T2D
2. Increased plasma noradrenaline in adults with T2D
3. **Reduced plasma noradrenaline in adults with T2D**
4. None of the above

3) What diagnosis is affected by prolonged standing?

1. Spinal Stenosis
2. Spondylolisthesis
3. Hypertension
4. **All of the above**

4) What information should be considered when making recommendations for sitting and standing time ratios?

1. Patient's cardiovascular health
2. Patient's body mass
3. Patient's tolerance for spinal flexion and extension

4. **All of the above**

5) **What is the optimal referral source for patient ergonomic training that will address aspects of behavioral health, physical rehabilitation, environmental modification, and disease process?**

5. **Occupational therapy practitioner**
6. Patient employer
7. Patient online resources
8. Athletic trainer

Question 6: Do you agree that this information is applicable to your current patient population?

0	1	2	3	4
Strongly Disagree	Disagree	Somewhat agree	Agree	Strongly Agree

Question 7: How likely are you to utilize this information in future patients' plan of care as deemed applicable and appropriate?

0	1	2	3	4
Very Unlikely	Unlikely	Somewhat likely	Likely	Very Likely

Question 8: Do you feel that it is reasonable to incorporate the brief screening questions into patient treatment sessions?

0	1	2	3	4
Completely Unreasonable	Somewhat unreasonable	Somewhat reasonable	Reasonable	Very reasonable

APPENDIX M- Post-Test Delayed Retention Questionnaire

1) **Prolonged sitting effects which body systems?**
    1. Musculoskeletal
    2. Cardiovascular
    3. Endocrine
    4. **All off the above**
2) **What is the result of interrupting prolonged sitting with brief bouts of light-intensity walking or Simple Resistance Activities?**
    1. Increased resting BP and in adults with T2D
    2. Increased plasma noradrenaline in adults with T2D
    3. **Reduced plasma noradrenaline in adults with T2D**
    4. None of the above
3) **What diagnosis is affected by prolonged standing?**
    1. Spinal Stenosis
    2. Spondylolisthesis
    3. Hypertension
    4. **All of the above**
4) **What information should be considered when making recommendations for sitting and standing time ratios?**
    1. Patient's cardiovascular health
    2. Patient's body mass

3. Patient's tolerance for spinal flexion and extension
4. **All of the above**

5) **What is the optimal referral source for patient ergonomic training that will address aspects of behavioral health, physical rehabilitation, environmental modification, and disease process?**

1. **Occupational therapy practitioner**
2. Patient employer
3. Patient online resources
4. Athletic trainer

Question 6: Do you agree that this information is applicable to your current patient population?

0	1	2	3	4
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Question 7: How likely are you to utilize this information in future patients' plan of care as deemed applicable and appropriate?

0	1	2	3	4
Very Unlikely	Unlikely	Neutral	Likely	Very Likely

Question 8: How often have you incorporated the information received in this workshop into your recommendations for a patient plan of care? (posttest only)

0	1	2	3	4
Never	Rarely	1-3 times	Often	Very Often

Question 9: Do you feel that it is reasonable to incorporate the brief screening questions into patient treatment sessions?

0	1	2	3	4
Completely Unreasonable	Somewhat unreasonable	Somewhat reasonable	Reasonable	Very reasonable

Question 8: How often have you have you made referrals to occupational therapy for ergonomic training since participating in the workshop?

0	1	2	3	4
Never	Rarely	2-4 times	Often	Very Often

APPENDIX N- CITI Training Certificate

CITI PROGRAM

Completion Date 27-Sep-2017
Expiration Date N/A
Record ID 24591820

This is to certify that:

Allison Mula

Has completed the following CITI Program course:

BU RCR Program for Doctoral Candidates and Post-Docs (Curriculum Group)
BU RCR Program for Doctoral candidates and Post-Docs: Social and Behavioral (Course Learner Group)
1 - RCR (Stage)

Under requirements set by:

Boston University

CITI
Collaborative Institutional Training Initiative

Verify at www.citiprogram.org/verify/?wff907cb2-cac4-4051-92c3-b6f534868a8b-24591820

APPENDIX O- IRB Expedited Review Application

BU Charles River IRB
Application Form (Exempt)

SECTION A: PROTOCOL AND CONTACT INFORMATION

Protocol Number (To be assigned by IRB Office):	
Protocol Title:	Investigation of knowledge retention and translation of primary care physicians following participation in an ergonomic workshop focused on the risks of prolonged sitting and standing.
Principal Investigator (Name, degrees, licenses, etc.): ☐ Mr. ☒ Ms.	Allison Mula, MS, OTR/L, CEAS
Department/School:	Department of Occupational Therapy/College of Health & Rehabilitation Sciences: Sargent College
BU Mailing Address:	635 Commonwealth Ave. Room 511A Boston, MA 02215
Email:	kjacobs@bu.edu
Telephone:	617 353-7516
Additional Contact Person:	Dr. Karen Jacobs
Email:	kjacobs@bu.edu
Telephone:	617-353-7516

☒ YES (REQUIRED)	I confirm that I qualify to serve as the Principal Investigator of this study and am in compliance with the following policies: http://www.bu.edu/researchsupport/forms-policies/principal-investigator-responsibilities/

SECTION B: Funding

Provide information regarding ALL funding sources in this section.

Please check all that apply:	
☐	This research is funded Have you received Just In Time (JIT) Notification? ☐ Yes ☐ No
☐	Funding has been requested Have you received Just In Time (JIT) Notification? ☐ Yes ☐ No NOTE: Once the funding has been awarded, submit a clarification to the IRB to add the funding source
☒	Research is not funded

If the research is funded or funding has been requested, it is required that you complete the box below. The Sponsor Award # must be included in the box below. If you don't have an award #, please state that in the box below. If you have multiple funding sources, add additional boxes as necessary.

Sponsor Name		NA
Title of Grant/Proposal		NA
Sponsor Award # (REQUIRED)* *If Award # is pending, put pending. Once the funding has been awarded, submit a clarification to the IRB to add the funding source		No award # has been provided.
YES	NO	
☐	☒	Is Boston University the Prime Awardee of the grant?
☐	☒	Is Boston University receiving a sub-award? Name of Prime Recipient:

*note: Provide a copy of the grant application, funding proposal, scope of work, or sub-award agreement. The University is required to verify that all funding proposals and grants have been reviewed by the IRB before funds are awarded.
If this research study is for your dissertation, provide a copy of your prospectus (if available).

SECTION C: conflict of interest

☒ YES (REQUIRED)	I confirm that all those responsible for the design, conduct, or reporting of the proposed program, including at minimum, all Senior/key personnel in the grant application, have completed the financial interest disclosure forms, submitted them to the COI office, and completed training as dictated at: http://www.bu.edu/researchsupport/compliance/conflicts-of-interest/, and as provided under the Boston University Policy on Investigator's Conflicts of Interest.
Of the financial interest disclosure forms submitted, has anyone checked "yes" to any of the questions on either the FIND1 or NONFIND1 form? ☐ Yes* ☒ No	

*If anyone checked "yes" to any of the questions on either the FIND1 or NONFIND1 form, the IRB Director will contact the COI office to obtain the disclosure information.

SECTION D: Type of review
For Guidance regarding Type of Review please refer to the following website: http://www.bu.edu/researchsupport/compliance/human-subjects/submitting-an-irb-protocol/.

Exempt Categories
In order for the study to qualify for exemption, the study must: 1) be no more than minimal risk* 2) fall into one of the categories below, 3) NOT involve prisoners, and 4) NOT be regulated by the FDA (with the exception of # 6).

*Minimal risk means that the probability and magnitude of harm or discomfort anticipated in the research are not greater in and of themselves than those ordinarily encountered in daily life or during the performance of routine physical or psychological examinations or tests.

Check all that apply:
1. ☒ Research conducted in established or commonly accepted educational settings, involving normal education practices, such as:
Research on regular or special educational instructional strategies, or
Research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.
2. ☐ Research** involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless:

Information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; AND
Any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability; or be damaging to the subjects' financial standing, employability, or reputation.
** Research activities involving children that may fall under this exemption are those involving educational tests or observation of public behavior where the investigators DO NOT participate in the activity being observed. Research involving children that uses survey or interview procedures and research involving the observation of public behavior if the investigators participate in the activity being observed would need to be reviewed by expedited or full board procedures.

3. ☐ Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under category (2) of this section, if:
The human subjects are elected or appointed public officials or candidates for public office; OR
Federal statute(s) require(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

4. ☐ Research involving the collection or study of existing*** data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available or if the information is recorded by the investigator in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.
***Data must exist at the time of IRB submission.

5. ☐ Research and demonstration projects which are conducted by or subject to the approval of federal department or agency heads, and which are designed to study, evaluate, or otherwise examine:
Public benefit or service programs;
Procedures for obtaining benefits or services under those programs
Possible changes in or alternatives to those programs or procedures; or
Possible changes in methods or levels of payment for benefits or services under those programs
Note: OHRP has determined that the following criteria (see 48 FR 9266-9270, March 4, 1983) must be satisfied to invoke the exemption for research and demonstration projects examining "public benefit or service programs" as specified under Department of Health and Human Services (HHS) regulations at 45 CFR 46.101(b)(5):
The program under study must deliver a public benefit (e.g., financial or medical benefits as provided under the Social Security Act) or service (e.g.,
social, supportive, or nutrition services as provided under the Older Americans Act).
The research or demonstration project must be conducted pursuant to specific federal statutory authority.
There must be no statutory requirement that the project be reviewed by an Institutional Review Board (IRB).

The project must not involve significant physical invasions or intrusions upon the privacy of participants.
Some HHS funding agencies require review of exempt studies. In those instances, the institution will consult with the HHS funding agency regarding the above conditions before invoking this exemption.

6. ☐ Taste and food quality evaluation and consumer acceptance studies:
If wholesome foods without additives are consumed; OR
If a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA or approved by the Environmental Protection Agency or the Food Safety and Inspection Service of the U.S. Department of Agriculture.
Note: The IRB will make the final determination on if the study qualifies for exemption

SECTION E: Study staff and human objects training
List ALL current members of the research team in the table below. Add more rows as necessary.
Note: For student research, the Faculty Advisor must be listed as a co-investigator in this section

Name, Degree, & Department/ School	Study Role (e.g. co-investigator, research coordinator, research assistant, project manager, lab manager)	Human Subjects Training*
Allison Mula, MS, OTR/L, CEAS	Principle investigator	☒ CITI ☐ Other**:_____ Most Recent Date Completed: 09-28-2017→09-27-2020
Dr. Karen Jacobs, EdD, OT, OTR, CPE, FAOTA	Co-investigator	☒ CITI ☐ Other**:_____ Most Recent Date Completed: 10-31-15→10-30-18
		☐ CITI ☐ Other**:_____ Most Recent Date Completed:

*For more information regarding the Human Subjects Training Policy, refer to the 'Training' section of the Policies & Guidance section IRB website http://www.bu.edu/researchsupport/compliance/human-subjects/. This site includes a

Study Personnel Training List. You can search this list by name to obtain the completion and expiration dates of training for investigators and study staff.
**If the investigator/study staff did not complete CITI, you must submit a copy of his/her training certificate.

Non-BU investigator staff ☒ N/A

Note: BUMC and BMC staff are considered to be non-BU staff and should be listed in this section. Add more rows as necessary. All the columns in the box below must be completed. In addition, you must complete the box that follows with a description of the activities for each staff member.
*If IRB approval will be obtained from the affiliate site, only list the lead investigator from the affiliate on this form.

SECTION F: Location of the research

YES*	NO	
☒	☐	Will this research take place at sites/locations other than Boston University? Note: If the research will take place at Boston University, state the location (Building and Room number): Workshop participation will be completed virtually on-line. The Primary-investigator will use their personal home office, located Vienna, VA 22181 to complete the majority of the study's responsibilities.

*If YES, please complete the boxes below

NOTE: You are responsible for obtaining permission/letters of support for research conducted off-site. This may include locations such as schools, workplaces, community organizations, etc. You must submit the letters/documentation of support with this application.

NA

Institution Name and Address (if known)	Describe Involvement (recruiting, consenting, data analysis, etc.) of the site. If the site staff is not involved/engaged in research procedures, state NONE. If the site staff will be involved/engaged* with research procedures, please complete the Engagement box below.
Allison Mula Vienna, VA 22181	Primary investigator will be involved in recruiting, consenting, data analysis, final report.

*Engagement in Research: http://www.hhs.gov/ohrp/regulations-and-policy/guidance/guidance-on-engagement-of-institutions/index.html

Engagement: N/A ☒ If the site staff will be involved/engaged in research procedures, one of the following must apply.		
YES*	NO	
☒	☐	The off-site location is requesting that the Boston University IRB review the protocol in place of local IRB review? *If YES, complete the Single IRB Review Form "Boston University is Institution A": http://www.bu.edu/researchsupport/compliance/human-subjects/.
YES*	NO	
☐	☒	The off-site location will obtain their own IRB/Ethics Approval. *If YES, submit a copy of the Approval letter .

YES*	NO	
☐	☒	Will this research be conducted outside of the United States?*

*If YES, complete the International Research Form at http://www.bu.edu/researchsupport/compliance/human-subjects/.

SECTION G: Study summary

Summarize the study in lay language (do not copy from the grant/scope of work/proposal, etc.). This summary should include the research design, purpose, objectives, research question, hypothesis, and any relevant background information. Note: Do not include citations in this section. Please limit this section to no more than 300 words.
In recent years, a greater awareness of workplace ergonomics has emerged. Physicians have begun to write more referrals for ergonomic evaluations and write notes that recommend specific equipment for the workplace. However, there is much to still consider in the areas of musculoskeletal discomfort and other risks of prolonged sitting and standing in the work place. Physicians already have a vast understanding of the mechanism of the human body and how activity or lack of activity affects that. Providing new information on opportunities to integrate ergonomics and movement into primary care considerations facilitates a better understanding of whom amongst their patients would benefit from the inclusion of ergonomic principles in daily occupations. The patient would also benefit from their physician's role in ergonomic considerations, as physicians have greater insight into the patient's full picture of health. The physician is in the best position to recommend things like sitting/standing time ratios and appropriate light resistive exercises to perform at work, and referrals to, or suggestions of, movement education workshops/sessions. In past studies, we see the benefits of ergonomic evaluation on musculoskeletal discomfort. In recent years, we are beginning to see more studies on the risks of prolonged sitting and standing on the neurovascular, cardiovascular, and endocrine systems. In this study titled: *Physicians' Role in Ergonomics Workshop: A pilot study,* we will carry out a predictive pilot study to determine if a workshop on ergonomics created for physicians, will result in information retention on ergonomic principles, and translate into physicians increased ergonomic considerations in the patient plan of care (POC). This will result in improved health and increased ability to participate in daily occupations. It is through analysis of data, that we can return to the program design to address any indicated shortcomings.

If you are applying for exemption under CATEGORY 1, provide the following information, as applicable: N/A ☐ Submit documentation of the school/organization permission If the PI plans to recruit from his/her own students, provide the plan (in the box below) for ensuring that the PI will not know which students are participating (e.g. having a co-investigator obtain consent, etc.) If the study will take place during regular class/school time, describe (in the box below) the plan for the students who don't want to participate and for ensuring that the study activities are not a significant deviation in time or effort from regular school/organizational activities Category 1: Research conducted in established or commonly accepted educational settings, involving normal education practices, such as: Research on regular or special educational instructional strategies (i.e. strategies that would be used regardless of whether this research study will take place), OR Research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.
A graduate student of the on-line post-professional doctorate in occupational therapy (OTD) program who is unfamiliar with the participants will be responsible for recruiting participants via continuing education staff or local medical practices, e-mail, obtaining consent, and monitor follow-up surveys process of 5 participants.

SECTION H: Subject population

Number of Subjects to be Enrolled: Note: Please account for subjects who may drop out or be withdrawn from the study.	5

Check all categories that apply to your target population:	
☒	Adults
☐	Children (< 18 years of age) Please specify the age range:
☐	Non-English Speaking
☐	BU Employees
☐	BU Students
☒	Other (please describe): Practicing Physicians

If Categories other than 'Adult' are checked, describe the additional safeguards that have been put in place to protect that subject population.
Workshop and Survey participation status will not be known to facility staff. Agreement in participation of the workshop will include agreement to participate in a pre-test with survey, and two post-tests with survey at 3 and 6 weeks following workshop completion. Names will be retained on consent forms. All identifying information outside of reported area of practice will be discarded and not included in final data analysis, outcome reports, or in any other manner. In order to insure confidentiality of information, a numeric coding system will be used to identify all participants. All data collection materials and data files will be numerically coded. The primary investigator who is unfamiliar to the physicians will collect and analyze the data.

Eligibility Criteria
Inclusion Criteria: Primary care/internal medicine/general medicine, or family practice physicians currently practicing in the Washington, D.C. metro area whose patient population consists of actively working adults. Ideally participating physicians will be in an out-patient office setting that performs yearly health exams and wellness visits.
Exclusion Criteria (exclusion criteria are the specific criteria which would disqualify an individual from participating in the study not simply the opposite of the inclusion criteria): Physicians that are not actively practicing medicine. Physicians with primarily pediatric patient population.

SECTION I: Recruitment

Provide a summary of the recruitment process, including who will recruit, when and where recruitment will occur, and how subjects will be identified. Note: Submit any recruitment materials such as advertisements, brochures, flyers, letters/e-mails, scripts, etc. Please submit these materials as separate documents in either Word or PDF format.
Potential subjects will be identified by the Principal Investigator, Allison Mula, who is a graduate student in the on-line post-professional doctorate in occupational therapy (OTD) program. A recruitment letter explaining the purpose of the research study will be e-mailed to potential participants by the Principle investigator. Potential participants will be scouted by discussing the purpose of the study with administration staff in free standing outpatient medical practices, and institutions of research and continuing education in the medical field. An example of this is the Claude Moore Education and Research Center and INOVA Fairfax Medical Campus (I am a PRN occupational therapist at INOVA Fairfax Hospital which is located on the medical campus). Recruitment flyers will be provided to administrative staff to disburse to potential participants. It is the administrative staff that will provide the emails of agreeable participants to me. With the provided emails, the first email will be sent out that includes the consent form, a purpose statement. The tentative date for contacting the potential subjects as described above is February 28th, 2018. Participants will have two weeks to consider whether or not they wish to participate in the study. The participants will receive two follow up e-mails within the 2-week period, one after the first week and another at the end of the second week.

SECTION J: Consent and assent

If the study involves interaction with subjects, there must be a consent process. Provide a summary (in the box below) of the consent process, including who will consent, and when and where consent will occur.

Note: Exempt studies do not require signed consent. However, there must be a consent script as part of the consent process. Submit copies of all consent scripts. Please submit these materials as separate documents in Word format.

The consent and/or assent script must include the following information: 1) that the activities involve research, 2) the procedures to be performed, 3) participation is voluntary, 4) the time involved for study participation, 5) how confidentiality of data is maintained, 6) risks of participating in the study, 7) benefits of participating in the study (if any), 8) name and contact information for the investigator, and 9) name and contact information for the BU IRB, if applicable.

Student researchers must: 1) indicate in the consent script that he/she is a student and 2) list the Faculty Advisor as a contact in in the consent script.

If you will NOT obtain consent and/or assent, provide the justification below.

Principal investigator Allison Mula will obtain informed consent from study participants. Participants will have two weeks to consider whether or not they wish to participate in the study. The participants will receive two follow up e-mails within the two-week period. A consent script will be provided in the first email communication through the internet, using electronic signature, prior to participation in the study.

With the provided emails, the first email will be sent out that includes and introduction and a purpose statement attached will be the consent form. The tentative date for contacting the potential subjects as described above is February 28th, 2018.

Indicate the consent and/or assent process and document(s) to be used in this study.

Consent: Adults (>18 years of age)	N/A ☐
☒	Adult Consent Script
Assent of Children (< 18 years of age)	N/A ☒
Note: Assent is not required for children under the age of 6. Parental permission only is required.	
☐	Assent Script
Parental Permission	N/A ☒

☐	Parental Consent Script

I will not obtain consent and/or assent N/A ☒

Note: This is only allowed for research which does not include direct interaction with human subjects (e.g. research that involves previously collected data)

CONSENT OF NON-ENGLISH SPEAKING SUBJECTS N/A ☒

Describe the process for obtaining consent from non-English speaking subjects. List the individual who will serve as the interpreter and his/her qualifications.

NOTE: A copy of the translated consent along with the Attestation Form for Translation of Consent must be submitted. The Attestation Form can be located at: http://www.bu.edu/researchsupport/compliance/human-subjects/.

SECTION K: Study Procedures

In the box below provide a detailed description of the study procedures to be performed (preferably in sequential order). Be sure to include the following information: Methods of data collection Details regarding research activities/procedures Number, frequency, duration and types of subject contacts (visits, phone calls, internet surveys, mailings, etc.) Time required from each subject Submit copies of all surveys, interview questions, assessments, screening scripts, etc. that will be used during the conduct of this study. Please submit these materials as separate documents in either Word or PDF format.
A recruitment letter explaining the purpose of the research study will first be e-mailed to potential participants by the Principle Investigator. The recruitment letter email will have a consent form attached. The tentative date for initial contact with the potential subjects is February 28th, 2018. Prior to starting the study, each participant will complete an informed consent form. Two follow-up e-mails will be sent to those participants who did not respond within one week of receiving the e-mail message. The first follow-up email will be sent one week after the initial email inviting the physician to participate in the research study; the second follow-up email will be sent two weeks after the initial email inviting the physician to participate in the research study, the participant will be given a week to respond after the second email. The predictive quasi experimental interrupted time series design for this study, will begin with collecting information to establish a baseline for the physicians' level of knowledge. This information will be quantitative and qualitative (Likert scale) and be collected before participants attend the ergonomic workshop. A pre-test will be provided with the consent form to establish the physicians' baseline level of knowledge of the workshop content. The physicians will attend a virtual ergonomic workshop on-line. Immediately following the workshop, the participants will follow a link to complete a posttest. The posttest will be taken again at 3 weeks and 6 weeks post-workshop. Comparison of the physician's pre-test knowledge to post-test knowledge will give us insight into whether or not knowledge was gained from the workshop. Posttest comparisons will provide data on knowledge translation and retention while providing qualitative data that gives insight into the workshops effect on change in physician practice behavior. The PI and co-investigator will meet to discuss and come to agreement with regard to interpretation. The pre/posttest will include no more than four fixed answer multiple choice questions and no more than 3 multiple choice Likert-style questions. Completion of the workshop is expected to take 20 minutes. Completion of the pre/posttest is expected to take approximately 5-10 minutes. A Feb 28, 2018 launch of the online workshop is tentatively planned, with data collection and statistical analysis beginning at initiation of consent form and pretest

and completed at the end of May 2018. A preliminary report will be derived from the quantitative data analysis by the end of June. It is anticipated that the final findings based on the research findings and a first draft of the research report will be completed by the beginning of July 31, 2018.
Following the completion of the study, the authors will use the generated data and analysis to return to the workshop framework and make any changes indicated by the data to develop an ergonomic workshop for physicians that will increase the inclusion of ergonomic considerations into primary care. It is anticipated that with the inclusion of ergonomics in primary care considerations and plan of care, that patients will receive recommendations that are appropriate to their individual needs, increased training and education on how to incorporate ergonomic principles in to daily occupations and utilize all ergonomic equipment safely.

Study Limitations
Small number (5) of participants will limit the generalizability of results.
May have difficulty finding participants.

SECTION L: Risks

Describe any expected risks to subjects. Consider physical, psychological, social, political, legal, economic, or other risks that are related to the study.
Physical, psychological, social, legal, or economic risks or discomforts are not anticipated as a result of participation in this study. Because participation is completely voluntary, participants have the option of discontinuing participation at any point, as described in the letter of consent (see attachment at end of IRB application).

Describe the plan to minimize risks. Include in the description the availability of any medical or psychological resources, if applicable.
Participants will have the option of discontinuing participation at any point, as described in the letter of consent (see attachment at end of IRB application).

SECTION M: Benefits

Describe the potential benefits to subjects related to the study. State if there are no direct benefits. NOTE: Compensation and/or course credit are not considered benefits.
As a result of participating in this study, participants may find the information in the workshop valuable and begin to integrate ergonomic considerations into the patient plan of care. It is hoped that the integration of ergonomic principles will enrich the scope of practice of primary physicians to address todays tech-based work environment health risks. The workshop will consist of a previously created online presentation. The presentation will contain video of persons demonstrating ideal and non-ideal body positions while performing computer-based work tasks, and movements or stretches that can be performed throughout the work day. Also included in the workshop will be animated charts and graphs to illustrate the physiological response of the body after prolonged sitting/standing/quality movement. The video will also highlight current options available for sit-stand desks. The workshop will be designed based on the principles of Richard Mayer's cognitive theory of multimedia learning.

Describe the potential benefits to society and/or others related to the study.
This pilot study will provide insight into whether or not the information provided in the workshop is considered applicable to the physicians' patient population, if physicians are found to have learned new information, and if they are applying what they learned in their practice. This research project may have indirect benefits of increasing physician awareness of the need to address ergonomic risks faced by patients that are currently working. It is hoped that with the incorporation of ergonomic considerations in the patient plan of care, ergonomics can be utilized as a preventative tool for musculoskeletal, neurovascular, and cardiovascular dysfunction and disease. Decreased chronic disease leads to better health and greater ability to participate in daily occupations, which may contribute to increased quality of life for patients.

SECTION N: Cost/payments

YES*	NO	
☐	☒	Are there any costs to subjects as a result of participating in this study? *If YES, provide a description of the costs:
☐	☒	Will subjects be compensated for participating in the study? Compensation may include cash, checks, gift cards, lotteries, course credit, etc.

SECTION O: Confidentiality of data

Describe how data will be stored (e.g. paper, electronic database, etc.).
All consent forms and other forms will be kept in a password protected folder. No names will be recorded, except on the participant consent forms. Consent forms will be kept separate from research records. All numeric data will be kept electronically in Allison Mula's computer using spreadsheet software (Microsoft Excel X), and will be password protected for access only by the researchers. Participant names will not be used in any reports or publications of this study. No other use will be made of these research records in the future. All information obtained in this research project will be considered confidential.

Per Boston University (BU) Record Retention Policy, records concerning human subjects must be retained for 7 years. Please refer to the policy at: http://www.bu.edu/policies/finance/record-retention/. As the investigator, you must also adhere to all applicable requirements as defined by regulatory agencies (e.g. FDA, etc.) or Sponsors.

YES*	NO	
☒	☐	Will you collect identifiable information? (e.g. names, social security numbers, addresses, telephone numbers, etc.) For a complete list of personal identifiers, please refer to the IRB website: http://www.bu.edu/researchsupport/compliance/human-subjects/hipaa/ *If YES, complete the box below
Describe the coding system* that will be used to protect the information including who will have access to the code. *Coding system: Coding systems are used to: 1) protect the confidentiality of the research data and 2) allow the investigator to link subjects to their responses. Each subject is assigned a unique study ID at the beginning of the study. A separate document (key) should be maintained that links the names of the subjects to the study ID numbers.		
In order to insure confidentiality of information, a numeric coding system will be used to identify all participants. All data collection materials and data files will be numerically coded. However, the name of the participant will be known to the PI.		
YES*	NO	
☐	☒	Will you share data with others outside of the study? *If YES, complete the box below
Describe how data will be transferred and how confidentiality will be maintained (e.g. identifying information will not be sent outside, etc.)		
NA		

Describe how you will maintain the confidentiality of the data (e.g. locked cabinet, password-protected files, encryption, etc.) Note: Confidentiality refers to the researcher's agreement with the participant about how the subject's identifiable private information will be handled, managed, and disseminated For further assistance and/or access to resources regarding information security, please refer to the BU Information Security website: http://www.bu.edu/tech/security/
All consent forms and other forms will be kept in a password protected computer. No names will be recorded, except on the participant consent forms. Consent forms will be kept separate from research records. All numeric data will be kept electronically on Allison Mula's computer using spreadsheet software (Microsoft Excel X), and will be password protected for access only by the researchers. Participant names will not be used in any reports or publications of this study. No other use will be made of these research records in the future. All information obtained in this research project will be considered confidential.

SECTION P: Privacy

Describe how you will protect the privacy of subjects. Include the following information: location of data storage, who will have access to study information, and location of study visits. Note: Privacy can be defined in terms of having control over the extent, timing, and circumstances of sharing oneself (physically, behaviorally, or intellectually) with others.
All consent forms and other forms will be kept in password protected file. No names will be recorded, except on the participant consent forms. Consent forms will be kept separate from research records. All numeric data will be kept electronically on Allison Mula's computer using spreadsheet software (Microsoft Excel X), and will be password protected for access only by the researchers. Participant names will not be used in any reports or publications of this study. No other use will be made of these research records in the future. All information obtained in this research project will be considered confidential.

SECTION Q: Health insurance portability and accountability act

YES*	NO	
☐	☒	Is this research being conducted in a covered entity? The following components have been determined to be covered entities on the Boston University Charles River Campus: Sargent College Rehabilitation Services Physical Therapy Center at the Ryan Center for Sports Medicine and Rehabilitation Sargent Choice Nutrition Center The Danielsen Institute Boston University Health Plan *If YES, contact the IRB office for assistance.

SECTION R: FERPA is the federal law that protects the privacy of student education records. Research funded by the Department of Education or research conducted in educational institutions that receive funds from the Department of Education (for research or other purposes) must comply with FERPA

YES*	NO	
☐	☒	Does this study involve collection of information from student school/university records? *If YES, refer to the following websites for guidance on FERPA: http://www.bu.edu/reg/general-information/ferpa/ http://www2.ed.gov/policy/gen/guid/fpco/ferpa/index.html http://www.bu.edu/researchsupport/compliance/human-subjects/. If FERPA applies, you must complete the box below:
In accordance with FERPA, written consent must be obtained to access student records. The consent must: Specify the records that may be disclosed State the purpose of the disclosure Identify the person or class of parties to whom the disclosure can be made Add signature lines to the consent statement if FERPA applies to the study.		
☐ YES (REQUIRED)	I confirm that I will comply with the FERPA policy that is in place at the educational institution where I am conducting my research. This includes, if applicable, the requirements for written agreement when requesting a waiver of consent for personally identifiable information. If an agreement is required, this agreement must be submitted to the IRB.	

SECTION S: PROTECTION OF PUPIL RIGHTS AMENDMENT (PPRA):
PPRA is a federal law that affords certain rights to parents of minor students with regard to surveys that ask questions of a personal nature. Research funded by the Department of Education or research conducted in educational institutions that receive funds (for research or other purposes) from the Department of Education must comply with the PPRA.

YES*	NO	
☐	☒	Does PPRA apply to this study? *If YES, refer to the following websites for guidance: http://www.bu.edu/researchsupport/compliance/human-subjects/. http://www2.ed.gov/policy/gen/guid/fpco/ppra/index.html If PPRA applies, you must complete the box below:
In accordance with PPRA, written parental consent must be obtained prior to subjects participation in the study.		
☐ YES (REQUIRED)	I confirm that I will comply with the PPRA policy that is in place at the educational institution where I am conducting my research.	

CERTIFICATION SIGNATURES: By submitting this protocol I attest to the fact that all research activities to be implemented related to human subjects have been completely and accurately described herein.

I agree to conduct the describe research in an ethical manner.

I agree to comply with all institutional policies and procedures related to human subjects research and will not begin any human subjects research activities until I have obtained full approval from the IRB.

I agree to conduct the research as described in this protocol and not to make any changes (except to eliminate immediate harm to subjects) without first obtaining approval for the changes from the IRB.

I agree to immediately report any unanticipated problems involving risks to subjects or others, any subject complaints, and any incidents of non-compliance with the requirements of this protocol as soon as I become aware of them.

I agree to comply with any relevant HIPAA and FERPA regulations if applicable.
I verify that all those responsible for the design, conduct, or reporting of the proposed program, including at minimum, all Senior/key personnel in the grant application, have completed the financial interest disclosure forms and completed training as dictated at http://www.bu.edu/orc/coi/forms/, and returned the forms to the Office for Research Compliance COI Unit. NOTE: If anyone checked “yes” to any of the questions on either

the FIND1 or NONFIND1 form, the IRB Director will contact the COI office to obtain the disclosure information.

PI printed name Allison Mula

PI Signature: Date: 12/02/2017

Submission
This form can be completed, signed, scanned and submitted to the IRB at irb@bu.edu. Faxed documents and handwritten materials are not accepted. Be sure to include all relevant attachments.

Faculty Research:

The Department Chair signature is required: This application must be signed by the Department Chair for all faculty researchers. If the PI is the Department Chair then signature by the appropriate Dean is required. Department Chair signature is not required for student research.

By signing this form, you are indicating that you have reviewed the application, the faculty/staff person listed as PI on this protocol is a member of your department, and that he/she is qualified to serve as the PI for this study, he/she has the adequate resources, and the research utilizes acceptable practice for the discipline.

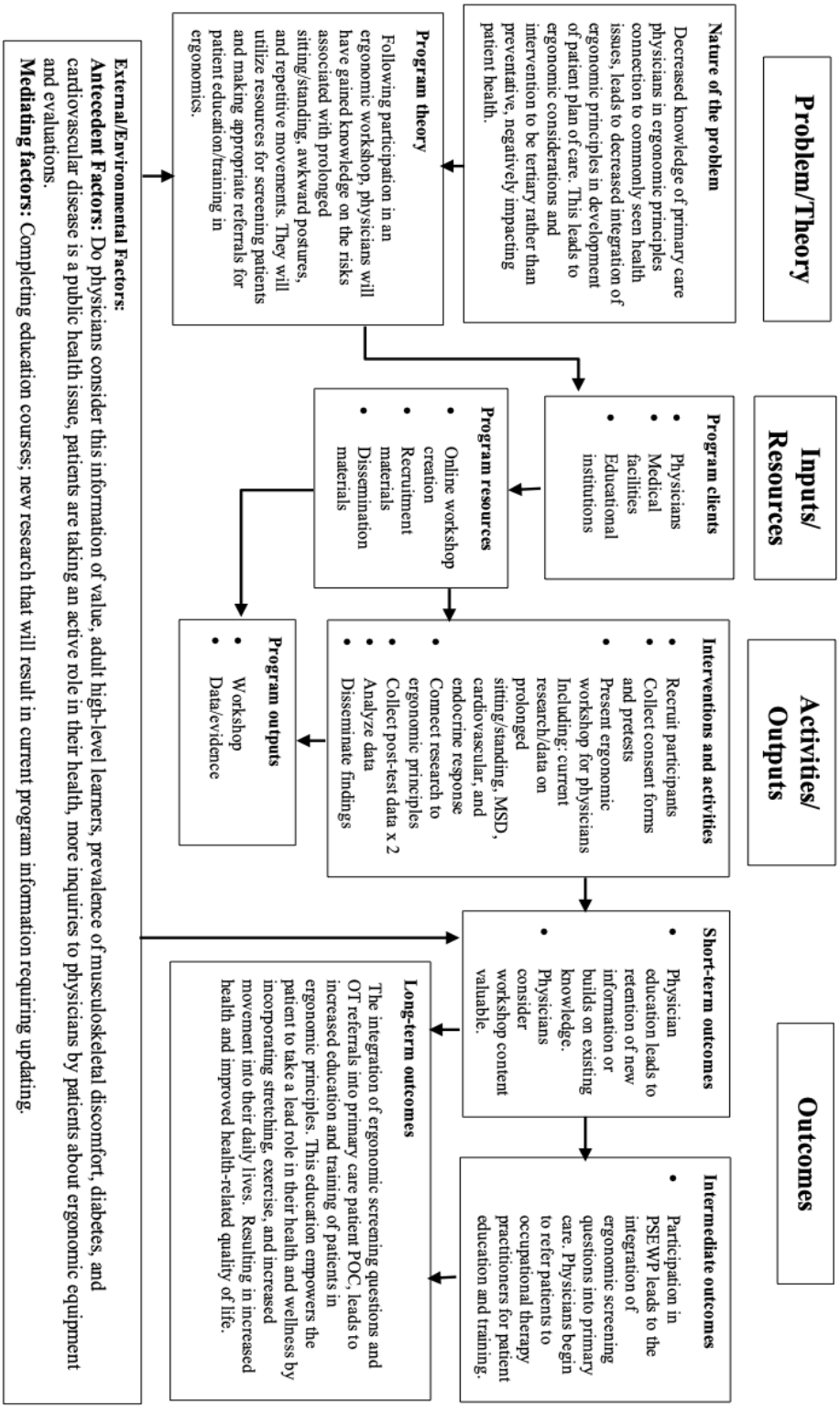
Department Chair (print name): Karen Jacobs

Department/School: Occupational Therapy

Signature:

Date: December 2, 2017

APPENDIX P- Logic Model Evaluation Plan



EXECUTIVE SUMMARY

Introduction

It is estimated that half of the U.S. workforce are required to spend some amount of time on a computer (Healy et al., 2016; Thorp et al., 2012; Amick, Swanson, & Chang, 1999; Bureau of Labor Statistics [BLS], 2005; National Institute for Occupational Safety and Health [NIOSH], 1999). Occupational physical activity trend analysis indicates that occupations that once required intensive physical activity now require much less physical activity, resulting in increased sedentary time (Church et al., 2011; Dunstan et al., 2013). It is reasonable based on this that the workplace has been identified as a key setting in which intervention to reduce sitting time would be beneficial (Healy et al., 2016; Thorp et al, 2012).

The evidence-based literature suggests that increased sedentary time is associated with diabetes, and other mortality causing diseases such as cardiovascular disease, and that time spent in prolonged sitting and standing, awkward postures, and repetitive movements has a deleterious effect on the musculoskeletal and physiological systems of the human body (Amick, et al., 1999; Bahk, Kim, Jung-Choi, Jung, & Lee, 2012; Baker et al., 2018; BLS, 1995; Church et al., 2011; Dembe, Erickson, Delbos, & Banks, 2005; Dempsey et al., 2016; Dunstan et al., 2013; Karakolis, Barrett, & Callaghan, 2016; National Safety Council [NSC], 2018a; NSC, 2018b; Mehrprarvar et al., 2014; Tissot F, Messing, & Stock, 2009; Tuchsen, Hannerz, Burr, & Krause, 2005; NIOSH, 2018; Wilmot et al., 2012).

Project Overview

The pilot study of the *Physicians' Role in Patient Ergonomics* workshop is an educational video presented through mixed media, exploring ergonomic principles and their relation to health issues commonly seen in primary care including; cardiovascular disease, diabetes, hypertension, and musculoskeletal disease (MSD). Activities will include participation by physicians in an ergonomic workshop that reviews the deleterious effects of prolonged sitting/standing, awkward postures, and repetitive movements (Amick, et al., 1999; Bahk et al., 2012; Baker et al., 2018; BLS, 1995; Church et al., 2011; Dembe et al., 2005; Dempsey et al., 2016; Dunstan et al., 2013; Karakolis et al., 2016; Mehrprarvar et al., 2014; Tuchsen et al., 2005; NIOSH, 2018; Wilmot et al., 2012).

Theory

Mayer's cognitive theory of multimedia learning (MCTML) and Knowles adult learning theory (KALT) are the basis for the design of information delivery, as there is evidence-based research that shows medical education programs that utilize these theories result in increased learning (Issa et al., 2011; Issa et al., 2013). MCTML rests on the main principles that there is an auditory and visual channel for processing information, and that these channels have a limited capacity to process information. It is through these channels that information is filtered, organized, and integrated with prior knowledge so that new learning takes place. MCTML provides guidelines to media design and presentation to reduce the risk of overloading the aforementioned channels and explains what specific combinations of media result in the most learning (David,

2015; Mayer, 2009; Issa et al., 2011; Issa et al.2013).

Purpose

The purposes of the pilot study of the *Physicians' Role in Patient Ergonomics* workshop are: (1) to determine if learning has occurred, (2) determine if the information is retained, (3) and determine whether information has been translated to physician practice behavior, evidenced by the integration of ergonomic principles into the patient plan of care (POC). The workshop aims to explain the relationship between occupational risks and commonly encountered public health issues. It is hoped that by highlighting the relationship between health issues and ergonomic risk factors, that physicians will find value in incorporating these ergonomic principles into the patient POC. Integration will be facilitated by providing "how-to" materials which will include suggested screening questions and a decision tree to make screening and the referral process more time efficient. Data will be collected through the analyzation of pre- and post-test questionnaires completed by the participant physicians. This data will be used to determine if the learning objectives of the workshop have been reached. The results will allow the author to draw conclusions and make inferences regarding the value of the workshop to physicians. This information will also clarify if changes need to be made to the workshop's content or delivery and can be used as a dissemination tool to recruit future participants and encourage its review by medical institutions.

Objectives and Content

Table 3.2
Workshop Learning Objectives and Content

Learning Objectives	Content
The physician will be able to describe the evidence-based literature on ergonomics and epidemiological statistics to appraise its value to their patient population.	3. Providing a review of current epidemiological statistics of cardiovascular disease, diabetes type 2, and MSD. Discuss their economic impact, and negative consequences on health-related quality of life. 4. Present evidence-based research on the risks of prolonged sitting/standing, and risks of awkward postures and repetitive movements. • Musculoskeletal • Cardiovascular • Endocrine • Cognitive
Physicians will demonstrate understanding of how to apply screening questions and decision tree tool to differentiate between appropriate and inappropriate patient referrals.	3. Provide evidence-based *how-to* materials for physicians that will aid in efficient decision-making when recommending sit/stand work stations and referring to OT. • Provide list of brief screening questions to incorporate into patient treatment sessions to determine if the patient is exposed to any ergonomic risks in their daily lives. • Provide quick reference guide for physicians that will allow for efficient review of whether a patient may benefit from a sit/stand desk referral.
Physicians will relate patient needs for ergonomic education and training to occupational therapy practice frame work.	6. Discuss awareness of existing time constraints that physician's face in carrying out preventative screening during treatment sessions. 7. Explain occupational therapy practitioner's role as part of the primary care team to relieve physicians of the role of ergonomic educator/training.
Following data analysis of the program, medical institutions will examine and appraise the PSEWP to	5. Follow a predictive quasi-experimental, interrupted time series design 6. Data results will be plotted onto a line graph. A visual inspection of the graph will allow us to begin utilization of

assist with development of medical school curriculum that includes OM education, specifically ergonomics.	the algorithm for analysis of data from the sum of squared deviations (SSD) (Niemeyer & Duddy, 2017). 7. Calculate C and Z statistics utilizing an excel spreadsheet. 8. Utilize inferential statistics to compare data and draw conclusions regarding physician use of resources and retention/translation of information (Simpson, 2015).

Key Findings

Based on a review of the available evidence-based literature on the topic, there is a lack of occupational medicine, specifically ergonomics, education in the medical school curriculum (The Accreditation Council for Graduate Medical Education [ACGME], 2018a; Frazier et al., 1999; Michas & Iacono, 2006; Russ et al., 2012; Smits et al., 2011; Yildiz, Bilar, Camur, & Caman, 2012). According to the Institute of Medicine (IOM) (2009), there is a national shortage of occupational and environmental medicine physicians, this shortage reduces the available faculty in medical schools and presence in the primary care setting (Castorina & Rosenstock, 1990; Michas & Iacono, 2008). For this reason, it is especially important that primary care physicians are trained to screen and care for patients with occupational injuries (Michas and Iacono, 2008).

Time constraints may contribute to the lack of ergonomic screening in primary care office visits. With multiple preventative screenings already required by physicians, additional preventative screening may be considered unreasonable (Yarnall, Pollak, Ostbye, Krause, & Michener, 2003). However, it must still be considered a priority as occupational risks (e.g. awkward postures, repetitive movements, overexertion, and increased sedentary time) can negatively impact patient health (Bahk et al., 2012; Baker et al., 2018; BLS, 1995; Church et al., 2011; Dembe, Erickson, Delbos, & Banks, 2005;

Dempsey et al., 2016; Dunstan et al., 2013; Karakolis, Barrett, & Callaghan, 2016; National Safety Council [NSC], 2018a; NSC, 2018b; Mehrprarvar et al., 2014; Tissot F, Messing, & Stock, 2009; Tuchsen, Hannerz, Burr, & Krause, 2005; NIOSH, 2018; Wilmot et al., 2012).

It is estimated that $15.1 billion a year, which is 25% of total workers' compensation costs, are due to workplace overexertion (NSC, 2018a; NIOSH, 2018). The CDC reports that 9.4% of the US population have diabetes, and that 33.2% have hypertension (CDC, 2018a; CDC 2017). Multiple evidence-based studies have shown the negative impact of sedentary behavior on individuals with diabetes and hypertension, making this population more vulnerable to exposure to occupational risk factors (Wilmot et al., 2003; Dempsy et al., 2016).When we consider the impact of MSD and diabetes and their correlation with ergonomic risk factors, we can surmise based on the prevalence of MSD and diabetes, that the connection between sedentary behavior (prolonged sitting/standing) and overall health and wellness of the US population needs to be taken seriously, especially with the rising concern of healthcare costs in the United States.

Estimated Costs

Pilot Study (Phase One)

The most significant cost of carrying out the *Physicians' Role in Patient Ergonomics* workshop will be the preliminary expenses of the graphic design (creating the video itself). The initial phase will be professionally complied but is not expected to be of commercial quality. The utilization of the Animaker© online application subscription for the creation of animation will be of minimal expense. A monthly

subscription to online survey creation and access for the pre-post tests will be utilized only during the phase of active data collection. Because this is the first time this author has created a video of this magnitude, consultation and guidance from a graphic designer is warranted an estimate of $350 (W. Ramirez, personal communication, May 1, 2018). The final animation video will be accessible at no cost through YouTube©. As most dissemination materials will be in an online format or delivered through in-person verbal report, expenses for dissemination will consist of paper brochures and compilation of physician advocate video. The overall cost for the first year is estimated at $1,632.

Funding

Sponsorship and Investors

To fund the Physicians' Role in Patient Ergonomics workshop pilot study, personal investment, sponsorship, company investment, and grant funding will be explored. Because the estimated cost of the pilot study is just over $1,600.00 it is reasonable that the author/creator of the workshop can fund the initial phase through personal funding.

Because the workshop advocates for the integration of ergonomics into primary care and may result in an increase of ergonomic evaluation referrals, ergonomic companies or companies that create ergonomic equipment may be interested in investing in the creation of the workshop, or sponsoring advertisement for the workshop. Because the workshop targets the topics of musculoskeletal disease, diabetes, and cardiovascular health which are considered to be public health issues, federal or state grants may an additional source of funding

Recommendations

From the evidence-based literature and increasing public concern for healthcare costs, we can appreciate that the topic of work-place health is important. It is crucial that we acknowledge the limitations and time constraints of the current medical system and find methods by which patients can be screened for occupational risk exposure and receive ergonomic training and education. Occupational therapy practitioners can serve as part of the primary care team by providing ergonomic training to patients that are found to be exposed to occupational health risks associated with a sedentary lifestyle, awkward postures, and repetitive movements.

General Conclusions

The *Physicians' Role in Patient Ergonomics* workshop will serve as a tool to connect commonly seen health issues to commonly encountered occupational risks encountered by patients. By incorporating screening questions into patient treatment sessions, physicians can efficiently identify patient's that may be vulnerable to occupational risk exposure and provide referrals for education and training to occupational therapy practitioners. By showing the value of the program through pilot study outcomes and physician testimonials, the audience of the program can expand to medical education institutions. Through the integration of ergonomic principles into the patient POC, it is anticipated that patients will reduce their exposure to the deleterious effects of awkward postures, repetitive movements, and sedentary time experienced at work and in other daily occupations (Wilmot et al., 2003; Dempsey et al., 2016).

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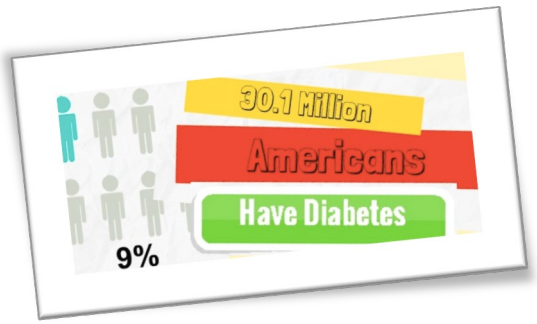
FACT SHEET

Physicians' Role in Patient Ergonomics Workshop

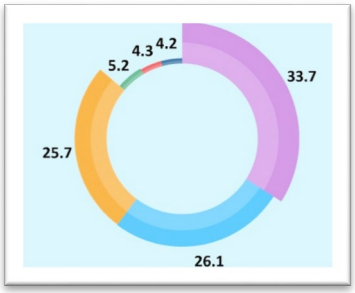
Ergonomic Principles

- Break up periods of prolonged sitting and change position often
- Neutral and supported body postures reduce strain
- Decrease small repetitive movements to reduce the risk of injury (OSHA, 2018)



What is the Relationship Between Ergonomic Principles and Public Health Issues?

- It is estimated that half of the U.S. workforce are required to spend some amount of time on a computer/screen-based system (Amick, Swanson, & Chang, 1999; NIOSH, 1999)
- Occupational physical activity trend analysis indicates that occupations that once required physical activity now require less physical activity, increasing the occurrence of sedentary behavior (Church et al., 2011; Dunstan et al., 2013)
- Evidence-based research suggests that increased sedentary time is associated with diabetes, and other mortality causing diseases such as cardiovascular disease (Wilmot et al., 2014)



- The top work-related injury cause is overexertion and bodily reaction (lifting, pushing, pulling, repetitive motion), which makes up 33.7% of all non-fatal work-related injuries (NSC, 2018)

Why Should Physicians Care?

When we consider the impact of musculoskeletal discomfort/disease and diabetes and their correlation with ergonomic risk factors, we can surmise based on the prevalence of MSD and diabetes, that the connection between sedentary behavior and overall health

and wellness of the US population needs to be taken seriously, especially with the rising concern of healthcare costs in the United States.

Why is an Educational Workshop Needed?

Based on a review of the available evidence-based research on the topic, it is clear that there is a lack of occupational health, specifically ergonomics, education in the medical school curriculum (The Accreditation Council for Graduate Medical Education [ACGME], 2018; Frazier et al., 1999; Michas & Iacono, 2006).

How Can Physicians Integrate Ergonomics?

- Integrate brief screening questions into patient treatment sessions
- Utilize occupational therapy (OT) practitioners as a referral source for ergonomic training and education

What is Occupational Therapy's Role?

By acknowledging the importance of occupation to health and well-being, recognizing the challenges/potential risks to the completion of occupations, and understanding disease causation and process, occupational therapy practitioners can counsel, modify environments, and provide necessary technical devices to optimize occupational performance (Kielhofner, 2009).

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