HOW LONG CAN THEY STAND IT? EXAMINING THE EFFECTIVENESS OF REFLEXOLOGY AND A PASSIVE RELAXATION INTERVENTION IN IMPROVING HEALTH OUTCOMES IN WORKERS WHO STAND

by

Kathryn Kavanagh

A thesis submitted to the faculty of
The University of North Carolina at Charlotte
in partial fulfillment of the requirements
for the degree of Master of Arts in
Industrial/Organizational Psychology

Charlotte

2020

Approved by:

_____
Dr. Linda Shanock

_____
Dr. Jaime Bochantin

_____
Dr. Alyssa McGonagle

©2020
Kathryn Kavanagh
ALL RIGHTS RESERVED

ABSTRACT

KATHRYN KAVANAGH. How long can they stand it? Examining the effectiveness of reflexology and a passive relaxation intervention in improving health outcomes in workers who stand. (Under the direction of DR. LINDA SHANOCK)

Many jobs require workers to stand for prolonged periods of time while performing their job duties. Prolonged standing at work has been linked to negative health outcomes, particularly musculoskeletal symptoms (MSS) and fatigue. Reflexology is one type of complementary and alternative medicine technique that may be well-suited to reduce musculoskeletal symptoms, fatigue, stress, and anxiety in workers who stand for prolonged amounts of time, because it involves stimulating reflex points on the feet that are purported to correspond to different bodily parts, increase relaxation, and reduce stress. Additionally, general relaxation techniques applied to the feet and lower leg, combined with passive relaxation time, may also provide some relief. In the current repeated measures, multilevel study, participants are randomized to either a reflexology condition or a passive relaxation condition, and their self-reported levels of MSS, fatigue, stress, and anxiety are assessed for two weeks at pre-test, two weeks during the intervention stage, and two-weeks post-test. Multilevel analyses reveal that participants in both groups reported significant reductions in scores across all measures from pre-test through intervention, but that the decreases did not vary significantly by condition for any outcomes except anxiety. Results substantiate previous findings regarding the prevalence of negative health outcomes in standing workers, and provide support for the use of reflexology or relaxation in helping to alleviate those outcomes.

ACKNOWLEDGEMENTS

I would like to thank my advisor and committee chair, Dr. Linda Shanock, for the knowledge, support, and guidance she provided me throughout the entirety of this project. This thesis would not have been possible without her subject matter expertise, passion, or mentorship. I am eternally grateful for the opportunity to work with her and learn from her, both for this thesis and beyond.

I would also like to thank my committee members, Dr. Alyssa McGonagle and Dr. Jaime Bochantin, for their knowledge, expertise, and constructive feedback along the way. Their disciplinary knowledge and advice were critical to the successful development and completion of this thesis.

TABLE OF CONTENTS

LIST OF TABLES vii

LIST OF FIGURES viii

CHAPTER 1: INTRODUCTION 1

1.1 Alternative Wellbeing Interventions and Reflexology 2

1.2 Standing at Work, Reflexology, and Musculoskeletal Symptoms 4

1.3 Standing at Work, Reflexology, and Fatigue 9

1.4 Standing at Work, Reflexology, and Stress 11

1.5 Standing at Work, Reflexology, and Anxiety 14

CHAPTER 2: METHOD 17

2.1 Participants 17

2.2 Procedure 20

2.3 Measures 23

CHAPTER 3: DATA ANALYSIS 28

3.1 Model Building 29

3.2 Qualitative Analyses 31

3.3 Supplementary Analyses 32

CHAPTER 4: RESULTS 33

4.1 Quantitative Findings 33

4.2 Qualitative Findings 36

4.3 Supplementary Analyses 39

CHAPTER 5: DISCUSSION 41

5.1 Theoretical Implications 41

5.2 Practical Implications 42

5.3 Limitations 43

REFERENCES 48

APPENDIX A: LIST OF BASELINE SCALES AND ITEMS 78

APPENDIX B: LIST OF WEEKLY SCALES AND ITEMS 83

LIST OF TABLES

TABLE 1: Cronbach's alpha values for focal measures at each time point.

TABLE 2: Means, standard deviations, and correlations with confidence intervals for focal variables at pre-test.

TABLE 3: Correlations between variables across pre-test and intervention time points.

TABLE 4: Means and standard deviations for outcome variables over time between groups.

TABLE 5: Growth curve model results for outcome variables from pre-test through intervention time points 1 and 2.

TABLE 6: Growth curve model results for outcome variables from pre-test through intervention time points 1 and 2, and the first post-test time point (one-week post-intervention).

TABLE 7: Growth curve model results for outcome variables from pre-test through intervention time points 1 and 2, and the second post-test time point (two weeks post-intervention).

TABLE 8: Qualitative themes and exemplary quotes during pre-test, intervention and post-test phases of the study.

LIST OF FIGURES

FIGURE 1: Participant flow diagram.

FIGURE 2: Interaction of Anxiety Scores by Condition over Time (Pre-test through Intervention).

FIGURE 3: Anxiety Scores by Condition over Time (Pre-test through Intervention, Second Post-test) including Regression Lines involved in Interaction of Time by Condition.

CHAPTER 1: INTRODUCTION

Many jobs require workers to stand while performing their job duties. In fact, a reported 38% of men and 30% of women in the U.S. work in jobs that involve standing all or almost all the time (Maestas, Mullen, Powell, von Wachter, & Wenger, 2017). Jobs that require a large amount of standing time may include but are not limited to retail workers, food service workers, health care personnel, and manufacturing workers. With such a high percentage of employees standing for their work, there is likely also a large overlapping percentage of workers feeling fatigued, in pain, and stressed as a result of this job requirement. There is ample evidence demonstrating a clear link between prolonged standing and lower back pain, physical fatigue, leg swelling, and musculoskeletal symptoms (e.g., Garcia, Läubli, & Martin, 2015; Orlando & King, 2004; Waters & Dick, 2015). Further, pain and musculoskeletal symptoms are also associated with psychological distress and psychosocial stressors (e.g., Houtman, Bongers, Smulder, & Kompier, 1994; Messing, Tissot, & Stock, 2006).

Despite the large number of workers who must stand for prolonged periods of time for their work shifts, and the negative health outcomes associated with prolonged standing, there is little empirical research focusing on addressing ways to improve these workers' health and work experiences. The few existing intervention studies have mostly been in the ergonomics literature and have focused on interventions like using different flooring conditions or floor mats, with mixed results (Orlando & King, 2014; Cham & Redfern, 2001). Research focused on easy-to-implement interventions that could be used during work breaks or off-work time and target workers' most painful or fatigued areas of their bodies would be an important step forward in alleviating the health issues faced by

workers who stand for their jobs. The current study takes an initial step in investigating how effective two relaxation interventions 1) reflexology (a complementary and alternative medicine (CAM) technique) and 2) brief foot and lower leg relaxation techniques followed by passive relaxation are in improving health outcomes in workers who stand for the majority of their work shifts.

1.1 Alternative Wellbeing Interventions and Reflexology

Alternative wellbeing interventions, often referred to as complementary and alternative medicine (CAM) cover a range of ancient to new-age approaches to preventing or treating disease that are not part of conventional medicine due to limited evidence to date regarding their effectiveness. CAM practices usually come from a holistic health perspective (e.g., considering the nutritional, emotional, or spiritual context in addition to the biochemical), and the majority of patients who use CAM approaches use them to complement conventional health care (Barnes, Bloom, & Nahin, 2008). Data collected from the National Health Interview Survey (NHIS), a nationally representative survey of the civilian non-institutionalized U.S. population conducted by the National Center for Health Statistics, indicate that the use of CAM, such as relaxation techniques (including meditation), yoga, chiropractic care, massage, and acupuncture, increased significantly from 2002 to 2007 (Su & Li, 2011). Patients often choose to engage in CAM due to dissatisfaction with or failure of conventional medicine, or they believe CAM to be more effective for treating certain conditions (Vincent & Furnham, 1996). Further, data on the use of prevalence of CAM indicates that the majority of therapy visits are for chronic conditions, particularly musculoskeletal pain (Paramore, 1997; Thomas, Nicholl, & Coleman, 2001).

Reflexology is a non-invasive alternative wellbeing technique that might be particularly applicable and beneficial to employees who stand on their feet at work, given it is focused on working directly on the feet and lower legs. The use of reflexology dates back to 3000 B.C. when it was first reported in Chinese literature, as well as depicted in Egyptian paintings (Stephenson & Dalton, 2003). Reflexology is rooted in zone theory, the theory that areas of our feet and hands map to different parts of the body, and applying alternating pressure to these reflex points may improve health outcomes (Marquardt & Myint, 2011). In reflexology sessions, a reflexologist uses specific techniques to apply pressure to reflex points on the feet that are believed to correspond to other parts of the body. In addition to potentially benefitting targeted areas of the body like the back, legs, and feet, this application of pressure to reflex points in the feet is thought to provide some overall benefits such as improving circulation, relaxing the body by activating the parasympathetic nervous system, and stimulating physiological healing responses in the body via the peripheral nervous system to the central nervous system, which in turn promotes healing and the body's return to homeostasis (Poole, Glenn, and Murphy, 2007; Stone, 2011).

Although the practice of reflexology has existed for centuries, research on the effectiveness and efficacy of reflexology as a medicinal or therapeutic practice is a relatively nascent field. Much of the existing research on reflexology has focused on its effectiveness at improving specific health conditions or symptoms (e.g., premenstrual symptoms (PMS), Oleson and Flocco (1993); pain and anxiety associated with breast cancer and lung cancer, Stephenson, Weinrich, & Tavakoli 2000). While it is certainly important to investigate reflexology as an effective alternative therapy for medical

patients with specific health challenges like breast cancer and PMS, there are other populations that could also benefit from reflexology research. As discussed earlier, one such population is workers who stand on their feet for their work shifts who could benefit from an easy-to-implement wellbeing technique, such as reflexology, that is directly targeted at their feet and lower legs to help reduce pain, fatigue, as well as overall anxiety and stress.

1.2 Standing at Work, Reflexology, and Musculoskeletal Symptoms

Workers in jobs requiring prolonged standing are at increased risk for development of musculoskeletal symptoms (MSS) such as back, leg or foot pain. The presence of musculoskeletal symptoms has been defined and measured as any ache, pain, or discomfort in nine bodily areas that involve the musculoskeletal system (neck, shoulders, upper back, lower back, elbows, wrists/hands, hips/thighs/buttocks, knees, and ankles/feet) (Kuorinka, Jonsson, Kilbom, Vinterberg, Biering-Sørensen, Andersson, & Jørgensen, K, 1987). MSS can also lead to more severe chronic pain and physical disabilities, and work-related musculoskeletal disorders account for the highest costs and prevalence of permanent disability among workers (Bureau of Labor Statistics, 2014; National Research Council, 2001).

There is a clear association between prolonged standing at work and musculoskeletal symptoms experienced by those workers, whose industries range from manufacturing to medical. In a cohort study of 5,604 Dutch workers in industrial and service companies, prolonged standing predicted low back pain (Andersen, Haahr, & Frost, 2007). In a separate study of Dutch manufacturing industry employees, 78% of 867 employees reported having health complaints in the last month, particularly

musculoskeletal pain, and found that prolonged standing was associated with leg, thoracic back, and low back pain (Roelen, Schreuder, Koopmans, & Groothoff, 2007). In a study on work-related musculoskeletal symptoms in grocery workers, Anton and Weeks (2016) found that approximately 80% of participants reported job-related musculoskeletal symptoms, with 51% of those workers reporting low back symptoms, and 50% reporting pain in their feet. Eleven percent of employees missed work due to symptoms and 25% sought medical care for symptoms. Hairdressing is another occupation that requires prolonged standing and is linked to musculoskeletal symptoms and disorders, most commonly neck pain, wrist/hand pain, and low back pain (Hassan & Bayomy, 2015; Mussi & Gouveia, 2008). In a study comparing respiratory and musculoskeletal symptoms in Egyptian hairdressers and office workers, the hairdressers reported significantly more MSS than the office workers, especially for neck, shoulder, elbow, hand and wrist, leg and foot, and back pain. Prolonged standing, manual handling, strenuous shoulder movements, and awkward body posture were all associated with the self-reported MSS (Hassan & Bayomy, 2015). Surgeons represent another occupation at risk for developing MSS due to standing at work. One study conducted by Dianat, Bazazan, Souraki, Azad, and Salimi (2018) found that 77.2% of surgeons reported musculoskeletal symptoms during the year prior to participation, most commonly in the knees, neck, low back, and shoulders, with 52.6% of surgeons reporting disruption of normal activities due to MSS. The risk of these symptoms also increased as the duration of surgery (i.e., time spent standing without breaks) increased. The prevalence of MSS, including but not limited to lower back pain, and thoracic back, neck, and foot pain and symptoms (Andersen, Haahr, & Frost, 2007; Anton & Weeks, 2016; Dianat, Bazazan,

Souraki, Azad, & Salimi, 2017; Roelen, Schreuder, Koopmans, & Groothoff, 2007;) in standing workers across various industries warrants investigation into interventions to decrease workers' pain and other symptoms and improve their well-being.

Reflexology may be an effective and simple intervention to reduce musculoskeletal symptoms, including pain, in these areas. The techniques involved in reflexology directly incorporate tactile relaxation techniques to the feet and lower legs to reduce pain in those areas (similar to massage). Further, the application of alternating pressure to reflex points that are theorized to correspond to areas of the brain that regulate pain perception (e.g., the pituitary gland) is thought to aid the process those brain areas initiate in returning the body to homeostasis. This contribution of reflexology in helping relieve pain is based on the neuromatrix theory of pain (Loeser & Melzack, 1999; Melzack, 1999). The neuromatrix theory proposes that pain is a multidimensional process, in which the "body-self neuromatrix" in the brain produces pain, or our perception of pain (see Melzack, 1999 for a review). The body-self matrix, coined by Melzack (1999), is posited to be a widespread network of neurons, distributed throughout areas of the brain, that "generates patterns, processes information that flows through it, and ultimately produces the pattern that is felt as a whole body possessing a sense of self" (p. 1380). Relatedly, reflexology is thought to affect the "complex inputs and processing in the neuromatrix of the brain" (Stephenson, Swanson, Dalton, Keefe, & Engelke, 2007, p. 128), such that it supports the processes that lead to an individual perceiving less pain and other processes that return one to homeostasis. Reflexology has also been proposed to relax tension and improve nerve and blood supply to organs and body parts, helping the body restore to homeostasis (Byers, 2001).

Reflexology has been studied on medical patients who experience chronic pain, with some promising results (Oleson & Flocco, 1993; Poole, Glenn, & Murphy, 2007; Tsay, Chen, Chen, Lin, & Lin, 2008; Hodgson, 2000). For example, Oleson and Flocco (1993) conducted a randomized control study on reflexology's effectiveness in treating PMS, including somatic symptoms such as breast tenderness, abdominal bloating, and menstrual cramps, and psychological symptoms like feeling anxious, depressed, irritated, or critical. Thirty-five participants received either ear, hand, and foot reflexology or placebo reflexology for 30-minute sessions over eight weeks. The reflexology group received reflexology from trained reflexologists on specific areas of the ears, hands, and feet that correspond to areas of the body appropriate for treating PMS, including the ovaries, uterus, pituitary gland, etc. Participants in the placebo reflexology group were given "uneven tactile stimulation" (i.e., very light or very rough) to areas of the ears, hands, and feet that are not appropriate for treating PMS, including the nose, ear, shoulder, etc. Participants in the reflexology treatment group reported significantly greater reduction in premenstrual symptoms than did participants in the placebo group, and this difference lasted for two months post-treatment. Although reducing premenstrual symptoms is outside the focus of the current study, this study does lend support for the use of reflexology in reducing painful somatic symptoms.

In addition, the effectiveness of reflexology in reducing chronic pain experienced by cancer patients has been explored in a few studies. Tsay, Chen, Chen, Lin, and Lin (2008) found that postoperative patients with gastric cancer who received reflexology reported less pain and anxiety after follow-up when compared to patients who received usual pain management. Additionally, Hodgson (2000) found that cancer patients who

received reflexology reported significantly lower pain levels than patients who received "placebo reflexology," or a gentle foot massage that did not stimulate reflex points on the feet. While these studies are limited by their small sample sizes, they employed a similar methodology to the one used in the current study: participants were randomly assigned to a 40-minute reflexology or "placebo reflexology" group involving gentle foot massage and were blind to the intervention.

In a randomized control study of reflexology in managing chronic lower back pain, 243 participants were randomized to either a reflexology group, a progressive relaxation group, or a non-intervention group. The reflexology group received treatment for six weeks from five reflexologists, and the progressive relaxation group received guided relaxation from four trained therapists. Participants' pain and physical functioning, depression, and general health were measured. Pain and physical functioning significantly improved for all participants, however, there were no significant differences between groups. The reduction in pain scores was largest in the reflexology group, however, although not significantly more than in the other groups (Poole, Glenn, & Murphy (2007).

Taken together, these findings suggest that it is plausible that reflexology may be effective in reducing pain of various kinds. Additionally, relaxation techniques or placebo reflexology also led to reduction in pain (e.g., Oleson & Flacco, 1993; Poole et al., 2007), though usually not to the extent experienced by participants who received reflexology. Thus, the current study hypothesizes that participants who receive reflexology and participants who receive brief foot and lower leg relaxation techniques followed by passive relaxation (henceforth referred to as the relaxation condition), will both report

reductions in pain and other musculoskeletal symptoms while receiving their respective treatments, but the reduction will be significantly steeper for those who receive reflexology.

H1a: Participants in both conditions will demonstrate a significant decrease in musculoskeletal symptom scores from pre-test through intervention.

H1b: The negative change trajectory in musculoskeletal symptom scores from pre-test through intervention will be significantly steeper for participants in the reflexology condition than for participants in the relaxation condition.

1.3 Standing at Work, Reflexology, and Fatigue

In addition to pain, workers who must stand for prolonged periods of time will likely experience fatigue from standing. Fatigue is a result of an increase in psychophysiological workload and reduced sleep, and can be categorized as acute fatigue or chronic fatigue (Querstret, Cropley, & Schaw, 2017). Acute fatigue is temporary and can be changed by rest and/or task moderation; it refers to a need to recover (Winwood, Lushington, & Winefield, 2006). Chronic fatigue is persistent and may be due to continuing to tax already overburdened systems (Querstret, Cropley, & Schaw, 2017; Winwood, Lushington, & Winefield, 2006). Workers who stand would likely experience acute fatigue that can be reduced when they get off their feet after a day of work, but they may also experience chronic, ongoing fatigue from ongoing standing at work over time. Several studies have demonstrated that prolonged standing tasks can increase acute physical fatigue reported by workers (Balasubramanian, Adalarasu, & Regulapati, 2009; Drury, Hsiao, Joseph, Joshi, Lapp, & Pennathur, 2008; Jorgensen, Hansen, Lundager, & Winkel, 1993; and Waters & Dick, 2015). For example, Garcia, Läubli, and Martin

(2015) found that participants who simulated standing work for five hours (including five-minute seated rest breaks and a 30-minute break) showed significant increases in both objective measures of acute muscle fatigue and subjective ratings of fatigue after their standing work shifts (although perception of fatigue did not persist 30 minutes after the work). In another study, production employees at a metal stamping company spent about 80% of their 12-hour shifts standing. These workers reported moderate to extreme fatigue in their lower backs and legs, and sEMG (an objective measure of muscle activity through electrodes that detect myoelectric signals) results revealed that all lower back and legs muscles were fatigued, as early as 20 minutes into their shifts (Halim, Omar, Saman, & Othman, 2012)

Fatigue has been measured in some existing studies of reflexology, with evidence that reflexology may reduce fatigue levels. For example, Wilkinson, Lockhart, Gambles, and Storey (2008) conducted a review of studies testing the efficacy of reflexology on cancer patients, and concluded that both reflexology and foot massage more generally may be helpful in reducing fatigue. As reflexology involves directly working to relax the person overall with direct stimulation on the lower legs and feet, reflexology would seem a good choice to help reduce physical fatigue from standing at work. Similar to the reduction in MSS experienced by participants who receive relaxation or placebo reflexology, participants may also experience some benefit when experiencing brief foot and lower leg relaxation techniques followed by passive relaxation. I expect participants who receive reflexology to experience greater reductions in fatigue than those who receive only brief foot and lower leg relaxation because during the reflexology intervention proposed for this study, the manual relaxation of the foot and lower legs

occurs throughout the entire session (30 minutes), as opposed to only during the beginning (5 minutes). Additionally, reflexology should, theoretically, stimulate the areas of the brain associated with pain reduction, fatigue reduction, and relaxation. Therefore, I hypothesize that participants in both groups will experience a reduction in fatigue scores from pre-test through the course of their intervention, but the reduction in fatigue will be significantly greater for participants who receive reflexology.

H2a: Participants in both conditions will demonstrate a significant decrease in fatigue scores from pre-test through intervention.

H2b: The negative change trajectory in fatigue scores from pre-test through intervention will be significantly steeper for participants in the reflexology condition than for participants in the relaxation condition.

1.4 Standing at Work, Reflexology, and Stress

It has been well established that employees in the U.S. often experience relatively high amounts of stress at work (e.g., Richardson & Rothstein, 2008). In addition to the usual stressors employees experience at work such as job demands and environmental stressors (e.g., time pressure, noise, and heat) (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001), employees who stand at work must deal with those stressors while experiencing an additional, ongoing stressor on the body. In the same study mentioned previously in which 75% of Dutch manufacturing industry workers experienced pain from standing, those employees who mentioned standing work were also significantly more likely to report feeling nervous or agitated (Roelen et al., 2007), which are symptoms of stress (e.g., Lovibond & Lovibond, 1995, Szabao, 2011).

Standing workers must face the normal demands of their job while also standing for hours on end, increasing their allostatic load and thus likely causing them to often feel stressed while at work. The allostatic load model of stress, coined by McEwen and Stellar (1993), is one of the leading stress theories. "Allostasis" means stability through change, referring to "the process of adjustment of various effector systems (cardiovascular, neuroendocrine, and others) that serve to cope with real, imagined, or anticipated challenges to homeostatic systems" (Ganster & Rosen, 2013; p. 1090). "Allostatic load" represents the consequences of chronic exposure to fluctuating or heightened stress responses, which can eventually reduce one's ability to cope with stress and regulate responses, which further perpetuates the stress cycle. The allostatic load model proposes a three-stage process, in which continued overstimulation of primary mediators (i.e., stress hormones that prepare the body to cope with demands) leads to dysregulation in secondary mediators (i.e., set-point adjustments in the immune, cardiovascular, and metabolic systems that, when consistently dysregulated, are risk factors for mental and physical diseases). If these secondary dysregulations are continued, this can lead to tertiary health outcomes (i.e., disease endpoints) (Ganster & Rosen, 2013).

The allostatic load model has been used in occupational health psychology as a theoretical model to explain the cumulative effect of stress on employees. Several studies have examined allostatic load theory in the workplace, and show support for the notion that work stressors are challenges to the homeostatic system, which can have negative consequences including increasing disease trajectories (Juster, McEwen & Lupien, 2010; Taylor Repetti, & Seeman, 1997). For example, in a study on female Swedish public health care workers, fatigue was associated with lack of recovery from work stress, and

demonstrated an increased risk for high allostatic load (von Thiele, Lindfors, & Lundberg, 2006). Higher work-related stress, operationalized as effort-reward imbalance, was also associated with higher allostatic load in German industrial workers (Mauss, Jarczok, & Fischer, 2016). Job factors like lower job control in Chinese industrial workers, higher job demands in Chinese employees, and effort-reward imbalance and burnout in female German schoolteachers have all been shown to be correlated with higher allostatic load levels (Bellingrath, Weigl, & Kudielka, 2009; Li, Zhang, Sun, Ke, Dong, & Wang, 2007; Sun, Wang, Zhang, & Li, 2007).

While occupational prolonged standing has not been a focal variable in studies of allostatic load thus far, prolonged standing likely represents a physical stressor of the job that increases the allostatic load of workers who must stand for most of or all of their work shifts. One of the main benefits of reflexology is to reduce stress and return the body to homeostasis (American Reflexology Certification Board, 2013; Stone, 2011). Reflexology reduces stress by increasing relaxation and helping the body return to homeostasis through various physiological mechanisms. Thus, reflexology may reduce the allostatic load of participants and allow their bodies to better anticipate and prepare for stressful demands (such as standing), and then react, cope, and recover appropriately with any work stress.

Few studies have investigated reflexology's use in reducing stress. One study conducted by Atkins and Harris (2008) investigated using reflexology for managing stress in the workplace. Although their final sample consisted of only four participants, they demonstrated promising results. Generally, participants reported improved levels of psychological wellbeing, stress symptoms, and musculoskeletal problems (with some

variance for different participants within these outcomes). I expect that reflexology will help reduce perceived stress in employees who stand at work. More generally, relaxation-based stress reduction interventions have been shown to be effective in reducing stress in a variety of populations (e.g., Bastani, Kazemnejad, Vafaei, & Kashanian, 2005; Yusufov, Nicoloro-SantaBarbara, Grey, Moyer, & Lobel, 2019). I hypothesize that participants who receive reflexology will show greater reductions in stress than those in the relaxation condition, due to reflexology's theoretical underpinning that reflexing certain areas of the foot that correspond to stress responses in the brain should promote stress reduction. Participants in the reflexology condition will receive reflexology which includes targeting these stress reduction points, whereas participants in the relaxation condition will not.

H3a: Participants in both conditions will demonstrate a significant decrease in stress scores from pre-test through intervention.

H3b: The negative change trajectory in stress scores from pre-test through intervention will be significantly steeper for participants in the reflexology condition than for participants in the relaxation condition.

1.5 Standing at Work, Reflexology, and Anxiety

The physical fatigue and pain are experienced by those who stand at work (e.g., Andersen, Haahr, & Frost, 2007; Anton & Weeks, 2015; Waters & Dick, 2015) may be linked to experiencing anxiety as well. If standing workers often experience chronic lower back pain and pain in other musculoskeletal regions, they may also experience pain-related anxiety associated with work and standing for long hours. As Boyd et al. (2016) explain, "as pain becomes chronic, anxiety and fear intensify and avoidance

behaviors become more frequent, interfering with daily activities and negatively affecting the patients' emotional wellbeing and quality of life" (p. 1758). Thus, there is a plausible association between the established pain and MSS resulting from prolonged standing and feeling anxiety related to that pain.

Reflexology may be able to help reduce anxiety in individuals, both through the predicted decreases in musculoskeletal symptoms and pain, as well as through the overall experience of relaxation and anxiety reduction participants often report due to reflexology (e.g., Stephenson, Weinrich, & Tavakoli, 2000; Vardanjani, Alavi, Razavi, Aghajani, Azizi-Fini, & Vaghefi, 2013). A few studies have investigated the use of reflexology in reducing anxiety. For example, one study examined the effects of reflexology on anxiety and pain in breast and lung cancer patients. Although researchers administered only one session and did not include any follow-up measures, they found that participants' reported anxiety and pain levels were significantly lower immediately following the reflexology session (Stephenson, Weinrich, & Tavakoli, 2000). In another study, 70 patients undergoing coronary angiography were randomly assigned to a reflexology condition or foot massage condition. Both groups showed significant decreases in anxiety 30 minutes after receiving their treatment, and the reduction in the reflexology group was significantly greater than that of the foot massage condition (Vardanjani, Alavi, Razavi, Aghajani, Azizi-Fini, & Vaghefi, 2013). The current study expands on these findings using a more robust, repeated-measures design, and tests the longevity of any reduction in anxiety that participants experience. Based on these study findings and the theoretical notion that reflexology's incorporation of reflexing areas of the foot that correspond to anxiety responses should result in decreased anxiety, I expect

that the reduction in anxiety will be greater for participants in the reflexology group than for participants in the relaxation group.

H4a: Participants in both conditions will demonstrate a significant decrease in anxiety scores from pre-test through intervention.

H4b: The negative change trajectory in anxiety scores from pre-test through intervention will be significantly steeper for participants in the reflexology condition than for participants in the relaxation condition.

CHAPTER 2: METHOD

2.1 Participants

Participants were recruited via flyers posted in campus buildings and through listserv emails sent to students, faculty, and staff of a large southeastern U.S. university. In order to qualify for participation, interested individuals had to be (1) at least 18 years of age, (2) working full- or part-time (i.e., at least 20 hours per week), (3) in a job that requires they stand for at least four continuous hours or at least half of their work shift, and (4) experience pain or fatigue from prolonged standing at work.

An *a priori* power analysis using G*Power was also conducted to determine the required sample size for the current study's design, which resulted in a total required sample size of N =28. Additionally, a minimum of 30 participants has been previously found to be adequate in providing enough statistical power to detect effects in within-person designs (Scherbaum & Ferreter, 2009). Given one of the main goals of this study was to examine within-subject change over time, we aimed to attain a sample size of at least 30 participants. Initial recruiting efforts involved presenting information about the study and distributing participant sign-up sheets to classes taught by university graduate students. This approach was not effective in obtaining interested participants, only one participant was successfully recruited using this method. The next recruiting effort involved posting flyers with relevant information about the study (including time involvement and incentive information) and contact information of the principal author in public boards and spaces around the university campus. This strategy was more fruitful, resulting in 15 individuals recruited to participate. Along with the posting of flyers, a second successful recruitment effort involved sending a mass email, sent through a

university listserv to university students, faculty, and staff. The email included the same relevant information about the study and the contact information of the principal author.

Over 300 students and staff members expressed interested in participating in the study through the mass email. The lead author contacted most of them (166), in the order interest emails were received, to provide them more information about the study, the time commitment involved for the study, and to schedule a time for an initial orientation session. Not all interested individuals were contacted due to the volume of emails and resource constraints to schedule and meet with each one. Of the 166 emailed, 54 participants agreed to attend an orientation session to meet the principal investigator and sign an informed consent form. A participant flow chart is displayed in Figure 1 to further describe process of arriving at the final sample size. The final sample consisted of 31 participants. Participants were randomly assigned to one of two conditions, either a reflexology condition ($N = 15$) or a relaxation condition ($N = 16$). Participants in the reflexology condition received 3-4 (participant schedule permitting) 30-minute reflexology sessions from a trained member of the researcher team which included 10 minutes of foot and leg relaxation techniques (five minutes at the beginning of the session and five minutes at the end of the session), and 20 minutes of reflexology techniques. Participants in the relaxation condition received 3-4 (participant schedule permitting) 30-minute relaxation sessions consisting of five minutes of foot and leg relaxation techniques at the beginning of the session, followed by 25 minutes of passive relaxation alone (more detailed description of the two conditions is provided in the Procedures section below).

On average, participants were 21.58 years old (*SD* = 4.40), with 73.33% identifying as female, in their third year of college (SD = 1.07), and were diverse in terms of race/ethnicity: 36.67% identified as being white, 26.67% identified as Asian, 26.67% identified as black or African American, 6.67% Latinx or Hispanic, and 3.33% American Indian or Alaskan Native. Participants worked an average of 25.16 hours per week (*SD* = 4.50), had an average tenure in their position of 13.97 months (*SD* = 13.00), and all participants were working in a paid position. The majority of participants worked in the food service industry (50%), retail (17%), and "other" (23%). Participants in the "other" category listed entertainment, health/hospital, customer service, warehouse, or engineering as their job type. Participants reported standing for 93% of their time at work (*SD* = 9.51) on average, and 73% reported that their workplace did not offer any standing accommodations (e.g., stool, standing mat, etc.).

The current study was funded through the Psi Chi Graduate Research Grant (awarded $1,500), which allowed for purchasing of study incentives and equipment. Participants received conditional incentives for completing surveys and attending their relaxation sessions. If participants attended both relaxation sessions and completed the accompanying survey for that week, they received a $10 Amazon gift card; attending all four relaxation sessions and completing both weekly surveys meant receiving $20 in Amazon gift cards. If participants met those requirements, and then completed the rest of the study surveys (two post-test and one final), they were entered into a random drawing for one of three $100 Amazon gifts cards.

2.2 Procedure

Interested potential participants came to an on-campus lab room to meet the principal investigator, learn what participation would involve, sign an informed consent form, and complete a baseline survey. Before signing the informed consent form, the principal investigator also verbally confirmed with each participant that they are eligible for participation (i.e., stand at work for at least four continuous hours during their shifts, and experience pain or fatigue from that standing). The baseline survey included demographic questions, job and standing-related questions, and the focal variable measures (i.e., MSS, anxiety, stress, sleep, and fatigue measures). The main purpose of the baseline study (besides gathering demographic variables) was to further confirm participants qualify for the study. To that end, in the baseline survey, participants were asked to report on such symptoms over the past month. See Appendix A for a full list of baseline survey items.

During this initial visit to the lab, participants also provided their typical work and class schedules for scheduling purposes. After the baseline survey, participants were sent a weekly survey for six weeks, followed by a final survey at the end. These weekly surveys included the same measures of MSS, anxiety, stress, and fatigue and asked participants to rate how much they had experienced them over the past week. All study surveys were distributed through the survey software Qualtrics, and the remainder of the study survey links were sent to participants via email. Participants were told that survey items would ask them to reflect on the past workweek, and were instructed to complete the surveys as soon as possible after their last work shift of the week. These weekly surveys also included qualitative questions about how participants felt physically and

mentally at work, outside of work, and, in the weekly surveys distributed during the intervention stage described below, we also asked participants how they felt during and after their relaxation sessions that week. See Appendix B for a full list of weekly survey items. Surveys were sent after participants completed their work shifts for the week, and relaxation sessions were scheduled before work shifts to the extent possible.

Pretest Stage. For the two weeks following the baseline survey completion, participants were sent their first two weekly surveys. Participants were asked to complete these surveys as soon as possible after completing their most recent work shift. The purpose of this pretest period was to establish participants' initial levels of the study outcome measures, before moving to the intervention phase, wherein participants received either reflexology or relaxation sessions four times during the two-week period. Scores on each outcome variable were averaged across these two weekly surveys so that the scores would be representative of, on average over the two-week pre-test period, the level of stress, anxiety, fatigue, and musculoskeletal symptoms the person was experiencing.

Intervention Stage. For the two weeks following the pretest stage, participants received four 30-minute relaxation (either reflexology or relaxation condition) sessions from the study researchers. All researchers received at least 50 hours of training in reflexology, under the supervision of Dr. Linda Shanock, nationally board-certified reflexologist with over 200 hours of training and 4 years of experience as a practicing reflexologist. Based on personal communications from two nationally board certified and experienced reflexologists, reflexology clients tend to report experiencing greater relief from and more prolonged reduction in symptoms after 3-4 sessions of reflexology, which

led to the decision of having participants receive four sessions (personal communication. Tacy Apostolik, April, 2018, Linda Shanock, April, 2018). Additionally, the body's immediate positive reactions to reflexology are thought to last for about 24-48 hours after a session, with cumulative positive effects building over multiple sessions (Teagarden, n.d.). In order for participants to experience the benefits of reflexology during their work shifts, all sessions were scheduled before a participant's work shift the same day, or when not possible, the day before a four-hour or more standing work shift. Sessions took place in the on-campus lab room where the baseline survey and orientation session occurred, with participants either lying face-up on a yoga mat on a table, or reclined back in a zero-gravity chair (once funding became available to purchase such a chair), while listening to the same calming music playing, and with dim lighting. The goal was to create a relaxing environment for all participants. The sessions for both conditions lasted 30 minutes. Participants in the reflexology condition received five minutes of foot and leg relaxation techniques (similar to foot massage), as well as a targeted standardized reflexology protocol. Participants in the relaxation condition received about five minutes of foot and leg relaxation techniques (similar to foot massage), followed by passive relaxation (i.e., they stayed reclining but did not receive any additional massage or reflexology) for the remaining 25 minutes of the 30-minute session. During this intervention stage, participants continued to complete the weekly surveys.

Posttest Stage. During the two-week period following the intervention stage, participants were asked to continue to complete the remaining two weekly surveys. The purpose of the posttest stage was to determine how long the potential benefits of reflexology and foot and lower leg relaxation may last. Participants were also sent a final

survey, asking for qualitative information about their experiences as a participant. Upon completion of the study, participants received debriefing information.

2.3 Measures

The measures below were administered to both intervention groups, and were included in each weekly survey. Cronbach's alpha values were calculated for survey measures from each weekly survey, see Table 1 for these reliability coefficients. The reliability coefficient values stayed relatively stable or increased over time, so reliability coefficients from the first pre-test survey and second post-test time points are reported below for the sake of parsimony. Average composite scores for each scale were used in the data analyses.

Demographic Information. Demographic information was collected in the initial baseline survey, including age, gender, race, student class, job type, job tenure, weekly hours worked, time spent standing at work, and whether standing accommodations were available at work. These variables were included for descriptive purposes only.

Musculoskeletal Symptoms. Prevalence of musculoskeletal symptoms was measured using an adapted version of the Somatic Symptom Scale-8 (SSS-8). The SSS-8 is a shortened version of the Patient Health Questionnaire-15. The SSS-8 measures symptoms including gastrointestinal, pain, fatigue, and cardiopulmonary symptoms by asking participants to assess the question, "During the past week, how much have you been bothered by any of the following problems?" The time referent was changed to "during the past month" in the baseline survey. Of the problems included in the measure, those that are relevant to the current study include the musculoskeletal symptoms of "back pain" and "pain in arms, legs, or joints," which are rated on a Likert-type scale

ranging from “0 = not at all” to “4 = very much.” In the SSS-8 pain in all three regions is assessed with just one item. We adapted the scale such that the item “pain in your arms, legs, or joints” was separated into three separated items: “pain your arms,” “pain in your legs,” and “pain in your joints.” Given that we were mainly interested in leg, back, foot, and joint pain for workers who stand, the item “pain in your feet” was also added to capture foot pain, a central component of the current study. The other unrelated scale items (i.e., stomach or bowel problems, fatigue, etc.) were also removed. The final scale included five items. This scale has previously been shown to have high reliability and is well-validated (e.g., Gierk, et al., 2014; Zijlema et al., 2013). This scale acts as an index, or formative measure, of MSS. Items in formative measures are not interchangeable (e.g., omitting one of the items would mean omitting part of the conceptualization of MSS) (Bollen & Lennox, 1991; Diamantopoulis & Winklhofer, 2001). Additionally, given the formative nature of this scale (i.e., the indicators “cause” the latent variable), traditional measures of validity and reliability (e.g., internal consistency) are not appropriate, because scale items may not correlate with each other but can still be important indicators of the construct (Diamantopoulis & Winklhofer, 2001).

Fatigue. Fatigue was measured through two scales. The first measure captures both physical and mental symptoms of fatigue generally, and the second measure focuses on fatigue levels of the legs, feet, and back, which are of particular interest for the current study. The first scale is the Fatigue Questionnaire developed by Chalder et al. (1993). This is an 11-item measure of fatigue, including seven items related to physical symptoms of fatigue and four items related to mental symptoms of fatigue. Example items include, “Do you have problems with tiredness? Do you feel sleepy or drowsy? Are

you lacking in energy? Do you have difficulty concentrating?" Items were modified to reference the past week given that our plan for the study was to asses these fatigue levels weekly (i.e., "In the past week, I have had problems with tiredness," etc.). Items are scored using a four-point Likert-type scale (e.g., better than usual = 0, no more than usual = 1, worse than usual = 2, much worse than usual = 3). The scoring anchors were modified for the current study to better reflect a response to the modified items (i.e., instead of answering a questions referring to prevalence of a symptom compared to one's usual feeling, participants are responding to an agree/disagree statement referencing the past week). Scores are summed for a total score of fatigue, higher scores indicating more fatigue. Internal consistency reliability has previously been shown to be strong, as well as evidence that construct and discriminant validity are supported (e.g., Chalder et al., 1993; De Vries, Michielsen, & Van Heck, 2003). At the first pre-test time point, the internal consistency of the items in this study's sample was good ($\alpha = 0.77$). The reliability of this scale increased over the course of the study, indicating high reliability of the scale by the second post-test time point ($\alpha = 0.89$).

The second fatigue scale was created based on a study conducted by Orlando and King (2004) investigating perceptions of fatigue and discomfort after prolonged standing on various flooring conditions. The specific items from this study were not provided, so the research team developed items based on the measure descriptions provided by Orlando and King (2004). The four items in this scale ask participants to rate their level of general body tiredness (i.e., weakness, fatigue), and tiredness levels of their legs, feet, and back. Participants indicated their tiredness levels on a 5-point Likert scale ranging from 1 (not tired) to 5 (very tired). We decided to ask participants about their "tiredness"

with the prompt "(i.e., weakness, fatigue)" instead of "fatigue" explicitly, due to concerns that not all participants would understand what fatigue means. This scale showed good reliability in our sample, with a Cronbach's alpha of 0.74 at the first pre-test time point, and increased to 0.89 by the second post-test time point.

Perceived Stress. Participants' level of perceived stress was measured by the commonly used Perceived Stress Scale-14 (PSS-14; Cohen, Kamarck, & Mermelstein,1983), a 14-item measure of stress during the previous month at work. Example items include, "In the last month, how often have you been upset because of something that happened unexpectedly?" and "In the last month, how often have you felt nervous and 'stressed'?" with answers ranging from "0 = never" to "4 = very often." Scores are obtained by reversing responses to the seven positively stated items and then summing responses from all scale items. This scale has previously shown to have high coefficient alphas in previous studies (Lee, 2012). The scale showed high reliability in the current study ($\alpha = 0.86$) at the first pre-test time point. At the second post-test time point, reliability had increased further ($\alpha = 0.90$)

Anxiety. The anxiety subscale of the Depression, Anxiety, and Stress Scale (DASS) was used to measure participants' anxiety and stress. This 7-item measure asks participants to rate how much statements have applied to them over the past week. Sample items include "I felt that I was using a lot of nervous energy" and "I felt I was close to panic." Participants rate the applicability of each statement on a 4-point Likert scale ranging from 0 ("Did not apply to me at all") to 3 ("Applied to me most of the time"). High reliability estimates for the anxiety subscale have been reported in previous findings (e.g., Brown, Chorpita, Korotitsch, & Barlow, 1997; Osman, Wong, Begge,

Freedenthal, Gutierrez, & Lozano, 2012). In the current study, this scale showed high reliability ($\alpha = 0.71$) at the first pre-test time point, with Cronbach's alpha increasing to 0.89 by the second post-test survey administration.

Qualitative Questions. As described above, weekly surveys also included qualitative questions asking how participants felt during their work shifts that week and outside of their work shifts that week (see Appendix B for actual wording of both questions). During the intervention stage of the study, participants were also asked how they felt during and after their relaxation sessions that week. Qualitative questions were included to allow for participants to describe their experiences in their own words, react to the sessions, and contextualize their quantitative responses.

CHAPTER 3: DATA ANALYSIS

The data were analyzed using a repeated measures approach to multilevel modeling (MLM). MLM offers statistical tests of main effects and interactions between variables at the within-person and between-person levels (Kristjansson, Kircher, and Webb, 2007). The current study used the MLM framework because it allows for examination of nested data—in the current study, time points are nested within participants. The repeated measures approach to MLM allows us to assess how participants' outcomes change over time, and allows for testing of whether that change is dependent on the intervention condition.

Analyses were conducted using R's nlme package (Pinheiro, Bates, DebRoy, Sarkar, & R Core Team, 2019), which fits a linear mixed-effects model while allowing for nested random effects. This analysis models initial starting points on all outcomes as well as participants' change trajectories in the outcome variables over the course of the study, and tests for significant differences in outcomes between groups and between time points. Composite scores for each measure were used in the analyses, (average of the items across the two pre-test time points, an average of the items after the first week of intervention, and an average of the items after the second week of intervention) and were calculated by averaging the item-level responses for each measure. MLM analyses require running four models. The four models assessed whether the participants' scores on all outcome variables differed at pre-test (null model), if their scores changed across the time points included (modeling time), whether the pre-test starting points on all outcome variables varied by condition (intercepts-as-outcomes model) and whether that change over time varied by condition (slopes-as-outcomes model).

3.1 Model Building

The first step in the analyses was to estimate a null model, to understand the percent of variance in outcome variables that is due to between-person variance vs. within-person variance. Null models were run for each outcome across the pre-test and intervention time points. This model is defined as:

Level 1
$Y_{ij} = \beta_{0j} + r_{ij}$
Level 2
$\beta_{0j} = \gamma_{00} + u_{0j}$

Results from this model are used to compute the intraclass correlation (ICC), which provides the percentage of variance in each outcome explained by between-person variability (instead of solely within-person variability over time). It is important to establish that between-person variability in our outcome variables exists given that our intervention (reflexology vs. relaxation condition) is at the between-person level. Therefore, there has to be some between-person variability in our outcome variables so that we can use intervention condition as a variable to potentially explain that between-person variability, in addition to explaining reductions in our outcome variables over time.

The second step was modeling time. This model tests whether there is a linear relationship between time and the outcome variable (on average). The formula below shows the form of this model.

Level 1
$Y_{ij} = \beta_{0j} + \beta_1(\text{Time}) + r_{ij}$
Level 2
$\beta_{0j} = \gamma_{00} + u_{0j}$
$\beta_1 = \gamma_{10} + u_{1j}$

Next, an intercepts-as-outcomes model was used to test the relationship between intercept values (pre-test starting point values) and condition, which explains whether participants' pre-test levels of each outcome vary by condition. This also serves as a randomization check—if the randomization of participants to each condition worked, a non-significant relationship between intercept and condition would be expected. The formula for this model demonstrates how this model estimates that the dependent variable is a function of the linear effect of the condition plus random error between those groups, plus the linear relationship of time plus random error. The slopes between time and the dependent variable are fixed, so are therefore assumed not to vary between groups (Bliese, 2006).

Level 1

$$Y_{ij} = \beta_{0j} + \beta_1(\text{Time}) + r_{ij}$$

Level 2

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Condition}) + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + u_{1j}$$

The final step in the MLM analyses was to predict slope variation using a slopes-as-outcomes model. This allows us to answer the focal question: does the growth trajectory in each outcome change over time, and does it vary by condition? The interaction between time and condition is added to the model here, which means we can test whether the participants' conditions explain their within-person change over time (Bliese, 2016).

Level 1

$$Y_{ij} = \beta_{0j} + \beta_1(\text{Time}) + r_{ij}$$

Level 2

$$\beta_{0j} = \gamma_{00} + \gamma_{01}(\text{Condition}) + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}(\text{Condition}) + u_{1j}$$

3.2 Qualitative Analyses

To analyze the qualitative responses from participants, a thematic analysis was conducted. Thematic analysis is "a method for identifying, analysing and reporting patterns (themes) within data. It minimally organizes and describes your data set in (rich) detail" (Braun & Clark, 2006, p. 79). Thematic analysis is also not prescribed to any one theoretical framework or epistemology, and is therefore open to a range of uses and interpretations (Braun & Clark, 2006). The principal author conducted the thematic analysis, using the guidelines and steps outlined by Braun and Clark (2006). To that end, after becoming familiarized with the qualitative responses, initial codes were generated. This coding was extensive and inclusive, and individual participant responses were often each coded as several different codes. Coding was organized by study stage; all responses from the pre-test stage were coded together, all responses from the intervention stage were coded together, and all responses from the post-test stage were coded together. This approach was used based on the assumption that different codes and themes would be different as participants progress throughout the study and experience their relaxation sessions. After generating initial codes, the principal author searched for themes in the codes. During this initial process, the themes of *tiredness, pain from standing,* and *sessions as positive experiences* immediately emerged. In the next step of thematic analysis, reviewing themes (Braun & Clark, 2006), the principal author checked if the themes worked in relation to the codes and the entire data set. The themes were reviewed and refined to ensure the data coded within each theme formed a coherent pattern, as well as the themes themselves accurately reflected the dataset. Next, themes were named and organized (see Table 8). Coding was conducted using the NVivo software program.

3.3 Supplementary Analyses

Additional analyses were conducted to assess how long changes in outcomes lasted into the post-test period of the study, or whether scores rebounded to pre-test levels after completing the intervention. To this end, the same repeated measures MLM analyses were conducted as described above, now including the two post-test time points. These analyses were run separately, such that the first set of models included pre-test through both intervention time points, plus post-test time point 1, and the second set of models included pre-test through both intervention time points, plus post-test time point 2. This approach was used to test whether the improvement in outcomes during the intervention stage lasted a week later into the first post-test time point, and then again whether those changes in scores lasted into the second post-test time point. Thus, it allows for a more robust explanation of if and how participants' scores change over time, and how long any intervention effects last.

CHAPTER 4: RESULTS

4.1 Quantitative Findings

The means, standard deviations, and correlations of each outcome variable at pre-test are displayed in Table 2. Correlations between the measures were somewhat in line with expected relationships. Unsurprisingly, anxiety was significantly moderately to highly correlated with fatigue, two variables which have been shown to be related and have reciprocal effects on each other (e.g., Servaes, Gielissen, Verhagen & Bleijenberg, 2007; Thorsteinsson, Brown, & Owens, 2019). Anxiety and stress were also significantly moderately correlated at several time points, which is line with previous findings on the association between stress and anxiety (e.g., Engert et al., 2018; Haghidi & Gerber, 2019; Thorsteinsson, Brown, Richards, 2014). Additionally, the two fatigue measures were significantly correlated, but the correlation values were not as high as expected. However, the first fatigue measure is broad and assesses both physical and mental fatigue, while the second fatigue measure asks about the fatigue of specific bodily most relevant to prolonged standing (e.g., feet, legs, back). Moreover, the moderate reliabilities for these two fatigue measures may be contributing to lower correlations between them. The second fatigue measure was significantly correlated with itself at different time points, which does provide some additional evidence for its reliability. MSS was significantly moderately correlated with anxiety and the first fatigue measure, and was significantly moderately to strongly correlated with the second fatigue measure. These correlations are in line with expectations that MSS, anxiety, and fatigue would likely be related to each other within the context of prolonged standing work. The strong correlation between MSS and the second fatigue scale, developed by researchers for this

study, provides some additional evidence that it is indeed capturing participants' fatigue of those specific areas asked about in the items. The items in this scale and the MSS scale both asked about either tiredness of or pain in (respectively) the legs, feet, and back, so this significant correlation may be a result of the items assessing similar symptoms and using similarly worded items. Correlations between the outcome measures assessed weekly across the first three time points (pre-test, intervention week 1 and intervention week 2) are displayed in Table 3.

To provide an overview of the general trends in scores over time between groups, means and standard deviations for each time point between groups are in Table 4. The multilevel modeling results further explain these trends and statistically test these change trajectories over time by condition. The results of the analyses followed the same general pattern for all four outcomes. The ICCs for each outcome variable established that there was a fairly large percentage of total variance in the pre-test value of each outcome due to between-person variability (53% for MSS, 18% for fatigue (1st measure), 43% for fatigue (2nd measure), 61% for stress, and 68% for anxiety) at pre-test. This is good news, in that a large portion of variability in each of our focal outcome variables over time seems due to between-person variability, which we hope to explain using our between-person variable, intervention condition.

The predicted intercept variation results demonstrated that the intercepts, or pre-test levels, did not vary significantly by condition for any of the outcome variables. In other words, as expected their initial levels of the outcome variables did not differ by condition. The time model results revealed that participants reported significant decreases (or improvement) in all outcomes from pre-test through the two intervention time points.

The only exception to this was stress; the marginal decrease in stress scores over this time period was nonsignificant. These findings provide support for *H1a, H2a,* and *H4a.* Qualitative data also support the finding that participants' levels of MSS, fatigue, and anxiety decreased over the intervention period. When asked how they felt after their sessions during the intervention period, one participant in the reflexology condition responded "my feet felt great with no pain which was awesome." Another participant in the reflexology condition wrote:

> "Physically, I think the sessions are helping a lot with my muscle tension that I've always had. When I wake up in the mornings, sometimes I stretch my body to be as long as possible and I'll catch a cramp in one of my calves. That hasn't really happened this week. Also when I would get up to walk, there would be uncomfortable tension in my Achilles and I would have to stretch it out. That also hasn't happened a lot lately."

Participants in the relaxation condition reported feeling better after their sessions as well. For example, one wrote "Tension released as well as feeling fairly refreshed. Legs and feet feel entirely different as if energy was put back into them." Another said "It certainly relieved my aching feet."

Anxiety was the only outcome that showed a significant decrease over time that varied significantly depending on condition ($\beta = 0.145$, $p < 0.05$). Hypotheses related to the difference in condition over time for the other outcome variables were not supported (*H1b, H2b, and H3b*). Table 5 consists of these model results for all four outcomes. A plot of the average anxiety scores over time by condition are is shown in Figure 2. This interaction plot is surprising, in that it reveals that the downward change trajectory in anxiety over time was actually steeper in the passive relaxation group. Thus, *H4b* was also not supported. These results should be interpreted with caution, however, as there

was very low variance in the anxiety scores. The average scores show that participants were reporting that the anxiety items did not apply to them at all or applied to them some of the time. And thus, the significant interaction of time and condition on the decrease in anxiety scores represents a change of half of a scale point. These findings are surprising in that they suggest that participants were not experiencing much anxiety across the study period at all, which runs contrary to the rationale used to hypothesize that standing workers may experience higher levels of anxiety.

Although not all the measures showed a significant difference in the decrease of scores by condition, it is a net positive that all participants did experience significant improvements in the measured health outcomes over time. While these results do not necessarily provide evidence that reflexology was a more effective intervention in improving health outcomes when compared to a passive relaxation group, these results do show that some physical foot and leg relaxation, quiet relaxation time, and repeated sessions, regardless of whether reflexology was included or not, were all related to participants feeling less anxious, fatigued, and experiencing fewer musculoskeletal symptoms over time.

4.2 Qualitative Findings

The qualitative thematic analysis of participant responses to their open-ended survey questions, described above, revealed several themes present in the data. These are organized by study stage: pre-test, intervention, and post-test, and by the survey questions themselves. See Table 8 for these themes, subthemes, code counts, and exemplary quotes. Generally, participants reported pain in legs, feet, back, and/or joints across all study stages, but less during the intervention and post-test stages, both in frequency of

responses coded for pain as well as participants reporting in their own words that they felt less pain. For example, several participants wrote that they experienced less pain at work during the intervention stage: one in the relaxation condition wrote “feet do not hurt nearly as much,” another in the same condition reported “my legs and feet didn’t hurt as bad as usual.” In addition to experiencing less pain, most participants described their sessions as positive experiences that they benefitted from generally. One participant in the relaxation condition wrote “I felt like last week - as if I had hit a restart button and was suddenly ready to take on everything. It was most beneficial mentally, but physically I also felt better than before the relaxation sessions. I want to continue doing something similar to the relaxation sessions, because they were so beneficial to me physically and mentally.” Another participant (in the reflexology condition) wrote, in response to asking how they felt during their sessions that week, “I felt like I was in another world. It was extremely relaxing and calming, it allowed me to take time to myself which is something that I don't usually have time to do.”

The qualitative data and findings provide plenty of support for the notion that these sessions, at the least, were relaxing. This was one of the most common responses/codes. Participants across both conditions seemed to agree. In response to the item asking how they felt during their sessions that week, one participant in the relaxation condition wrote, “I felt VERY relaxed, my body and mind felt at ease so much that I was able to sleep.” Another in the reflexology condition said, “The relaxation sessions were very nice to just take a break from everything and relax. This week was very stressful so I really appreciated a nice quiet break from everything.”

One interesting theme that emerged was the sessions as meditative experiences or environments. During the study period, participants were not instructed to meditate. However, multiple participants described meditating during the sessions or entering a meditative state. One participant in the reflexology condition wrote, “I felt calm and relax[ed]. I went into a meditation state where for a good 10 min[utes] I wasn't thinking about anything which I really needed. I don't get that when I'm sleeping because my dreams wake me up constantly. This was a good refresher before my next class.”

While it is clear the participants enjoyed their sessions and perceived some benefits from them, not all reaction or effects were as gleamingly positive. For example, some responses revealed that some participants felt that the positive effects of their sessions did not last. One participant in the relaxation condition noted, “Mental state and physical state was great immediately after the session, but faded as time passed (about 1 day).” Interestingly, a couple responses noted that they felt they would experience more benefit from the sessions if they received more continuously. One perceptive participant (in the reflexology condition) felt they would need more sessions to experience any long-term benefit: “They were very good and were able to relieve some of the tension in my legs and feet; however I feel this is something I would have to do long term to see lasting effects since I'm always on my feet.” A few participants reported that they felt nervous about the session, or that it was difficult to relax at first, but that eventually they were able to relax. For example, one participant in the relaxation condition wrote “I was definitely trying to relax as much as possible, but I kept thinking about things I had to do when I got back to my apartment, and all the work and assignments I had to get done before work.”

Taken together, the qualitative findings both complement and provide further support of the quantitative results. Participants from both groups found their sessions enjoyable and relaxing, and reported experiencing some benefits from their relaxation sessions.

4.3 Supplementary Analyses

Results from the supplementary analyses, which incorporated the two post-test time points into the multilevel models separately, demonstrate how long the improvements in the outcomes lasted into each of the two post-test time points (one week and two weeks post-intervention). The first set of models added the first post-test time point to the pre-test through intervention model. The ICC values were 0.54 for MSS, 0.25 for fatigue, 0.49 for fatigue (second measure), 0.62 for stress, and 0.59 for anxiety, representing the percent of between-person variance in the outcome measures across the time points. The changes in means on the outcome variables over time and by condition varied across outcomes (see Table 6). MSS, fatigue (both measures), and stress scores significantly decreased over time from pre-test to one week following the end of the intervention stage, but these significant decreases were not dependent on condition. Anxiety scores decreased over time, but the decline was not significant in the full model. This finding is interesting given that in the intervention models, anxiety was the only outcome that had a significant interaction in the scores over time by condition.

In the next set of models (see Table 7), change over time was assessed from pre-test and intervention scores to the second post-test time point (two weeks following the end of the intervention stage). The percentages of the total variance that were between-person variance were 31% for MSS, 29% for fatigue, 50% for fatigue (second measure),

33% for stress, and 56% for anxiety. MSS, fatigue (both measures), and anxiety scores all significantly decreased over time jumping from pre-test and intervention to the last post-test time point, but these changes did not vary significantly by condition. Stress did not show a significant decrease in scores. Taken together, these supplementary findings suggest that most of the benefits experienced by receiving both reflexology and passive relaxation continued even after the intervention ended.

CHAPTER 5: DISCUSSION

The current study's findings overall suggest that both receiving reflexology and receiving minimal foot and leg relaxation followed by passive relaxation had beneficial effects by reducing musculoskeletal symptoms, fatigue stress, and anxiety reported by participants. Participants in both groups showed significantly improvements in these health outcomes, but these improvements were not significantly dependent on condition. Participants also reported qualitatively that receiving their relaxation sessions was a positive and relaxing experience for them and one that they looked forward to. Their qualitative data also reiterates the prevalence of musculoskeletal symptoms, fatigue, and stress present in standing workers and associated with prolonged standing.

5.1 Theoretical Implications

The current study expands our understanding of issues faced by workers who are required to stand while performing their job duties and the usefulness of relaxation in alleviating some health problems associated with prolonged standing. The current findings replicate previous studies' findings regarding the prevalence of MSS and fatigue in workers who must stand for prolonged periods of time (e.g., Andersen et al., 2007; Anton & Weeks, 2016; Dianat et al. 2017; Halim et al., 2012; Roelen et al., 2007). Further, the current study demonstrates that both reflexology and passive relaxation can reduce MSS, fatigue, anxiety, and stress in standing workers, which supports previous work showing the efficacy of using reflexology and relaxation techniques more broadly to reduce some of these symptoms (e.g., Bastani et al., 2005; Yusufov et al., 2019). While the current study could not test the mechanisms behind how these relaxation sessions affected participants' brains and bodies internally, the results do question some of the

theoretical underpinnings of reflexology. For example, perhaps it is not the specific reflex points that lead to less pain or stress in the recipient, but the continual tactile stimulation of the feet that makes feet feel less pain or fatigue. Or, maybe the relationship formed between reflexologist or client (or participant in this case) over time partially leads to individuals feeling better or reporting less stress or anxiety. The psychological comfort that comes from human touch, attention, and care has been reported to be one of the primary benefits of reflexology (Gambles, Crooke, & Wilkinson, 2002).

The primary aim of this study was to conduct a more rigorous, well-designed test of the effectiveness of reflexology in improving certain health outcomes in standing workers, to help elucidate some areas where reflexology may especially useful or beneficial. To that end, we failed to provide evidence that reflexology was effective in doing so over and above passive relaxation. However, this study was the first to evaluate reflexology specifically within the context of standing workers, and further investigation into how it may or not help this population may be warranted.

5.2 Practical Implications

While these findings do not support that reflexology was a more effective intervention above and beyond passive relaxation, these results may underscore the importance of taking breaks at work or after work to relax and recover from problems experienced from standing at work. The fact that the current study's relaxation sessions did not occur during participants' work shifts, but mostly before (or sometimes after) a shift, and participants still benefited, shows the effect that off-work time can have on employees' health outcomes. Simply making uninterrupted time to relax, or even receive a short massage of the feet and/or lower legs, could help employees who have to stand on

their feet for hours on end feel less pain, fatigue, anxiety, or stress associated with their standing work.

The only outcome that showed a significant decrease in scores that varied by condition was anxiety. Interestingly however, anxiety decreased faster and more strongly in the passive relaxation condition than in the reflexology condition. A possible explanation for this finding could be that receiving reflexology was likely a novel experience for participants, so they did not relax as much during their sessions than participants who mostly relaxed on their own with just a brief amount of foot and lower leg relaxation techniques that probably felt familiar, like massage. Perhaps the continuous tactile stimulation on their feet for 30 minutes experienced in the full reflexology sessions, which involves different techniques than common massage techniques, or just participants' own curiosity about the mystery treatment, kept participants from fully relaxing. As noted earlier, there was also very little variance in the anxiety scores for either group across time, so these results, while statistically significant, may not be practically significant when considering the incremental change in scores.

5.3 Limitations

The current study is not without limitations, mostly concerning sample size, study design, and measures. While the current sample size is large enough for typical within-person designs that utilize multilevel modeling (Scherbaum & Ferreter, 2009), we would have ideally been able to collect data from at least 40 participants (to allow for 20 participants per group, which would result in more power to detect between-person differences by condition). However, the current study's data collection process is

currently ongoing for publication, and will therefore be updated when the 40-participant goal is reached.

As another possible limitation, the current study used weekly surveys that asked participants to retroactively recall their MSS, fatigue, stress, and anxiety experienced over the previous week. This is limiting in that it relies on participants to accurately remember and report their experiences, which may be influenced by biases and error, like memory errors, recency, and current affect (e.g., Robinson & Clore, 2002). For a survey-based design, distributing surveys right before and right after relaxation sessions, as well as during or after work shifts would have been a more robust and reliable data collection strategy. The weekly survey design used in the current study was implemented to circumvent possible participant survey fatigue. As it was, the participants responded to six weekly surveys that included the same measures, and adding more than that may have resulted in lower response rates, participant fatigue, and/or drop outs, or limited variability in responses over time due to seeing the same survey items over and over.

With regard to measures, there are several limitations. First, the data collected were subjective data about participants' perceptions of their health. Some objective and/or biometric indicators of outcomes like fatigue or stress could be used to better capture the physical health measures. However, participants' subjective experiences of these health measures were still of interest to the current study. Additionally, the survey measures used in the study were either adapted or in one case, created by the research team for this study. While adapting a scale is not necessarily inherently problematic, it does bring into question the validity of responses to those scales (Aguinis & Vandenberg, 2014). One outcome of modifying the scales used in the current study may be the

resulting shifts in internal consistency of scales from pre-test through post-test. Additionally, scales used in the baseline survey were modified to ask about the past month in some cases (as opposed to the past week), and, likely relatedly, the reliability coefficients for the baseline measures were low.

In terms of study design, there were inconsistencies with the scheduling of participants' relaxation sessions. For example, we tried to schedule relaxation sessions either the day of or before a participants' work shift, but this was not always possible. Sessions were sometimes scheduled after one of their work shifts, or we did not know when in relation to the session their next work shift would be. During the initial orientation session with participants, they provided their general work schedule and available dates to attend relaxation sessions, which was used to schedule their sessions before work shifts during available times. However, sometimes sessions needed to be rescheduled and/or their work schedules changed. This was difficult to track because of the volume of participants in different stages of the study at any given time, the fact that there were often two or three members of the research team communicating with their respective participant, and not having access to participants' class or work schedules. One possible way to circumvent this issue in the future may be to ask participants to provide their work schedule every week of their intervention stage, so that sessions could be more accurately scheduled and rescheduled if needed.

5.4 Future Research Directions

The two interventions in the current study may have been too similar to show significant differences between groups. Future research on the effectiveness of reflexology in improving health outcomes should consider using various types of control

groups. For example, future studies could include control groups that experience no tactile stimulation (i.e., all passive relaxation). This would further hone in on the effect of manual relaxation of the foot and whether that or truly passive relaxation is driving reductions in negative health effects. Additionally, other common stress interventions could be tested against reflexology, such as mindfulness-based stress reduction, progressive muscle relaxation, or yoga-based interventions. This approach would expand our knowledge of which types of these techniques might work better in different samples of workers—would reflexology be more effective in reducing pain or fatigue in standing workers than yoga? Is yoga more effective at reducing stress in office workers than in food service workers? This approach would also tell us more about which aspects of these techniques result in different outcomes—the active aspect of yoga versus the client-like aspect of receiving reflexology versus the focus and visualization of progressive muscle relation. Future research might also consider further investigating self-administered reflexology in reducing anxiety. Self-administered hand reflexology is an accessible, easy-to-implement reflexology technique that may show a similar pattern of results in decreasing anxiety and/or, especially given its focus on the area of the hand that purportedly corresponds to the adrenal cortex. This research could demonstrate promise for another simple technique aimed at reducing stress or anxiety that could also be teachable to a wider audience than traditional reflexology. The current state of the literature on workers required to stand for prolonged periods of time is lacking and requires further investigation and interventions. On the other hand, recovery from work stress is a field rich with theory and data, but could be expanded into this specific job context. To that end, another direction for future research may be to examine how to

make on-the-job rest breaks more beneficial for standing workers and their stress, anxiety, and fatigue levels. If these types of workers experience pain and fatigue while at work, interventions or techniques aimed at alleviating those symptoms while still at work are worthwhile research pursuits.

REFERENCES

Aguinis, H., & Vandenberg, R. J. 2014. An ounce of prevention is worth a pound of cure: Improving research quality before data collection. *Annual Review of Organizational Psychology and Organizational Behavior, 1*: 569-595.

American Reflexology Certification Board. (2013). *Foot Certification Study Guide*.

Andersen, J. H., Haahr, J. P., & Frost, P. (2007). Risk factors for more severe regional musculoskeletal symptoms: A two-year prospective study of a general working population. *Arthritis & Rheumatology, 56*(4), 1355-1364.

Anton, D., & Weeks, D. L. (2016). Prevalence of work-related musculoskeletal symptoms among grocery workers. *International Journal of Industrial Ergonomics, 54*, 139-145.

Atkins, R. C., & Harris, P. (2008). Using reflexology to manage stress in the workplace: a preliminary study. *Complementary Therapies in Clinical Practice*, *14*(4), 280-287.

Balasubramanian, V., Adalarasu, K., & Regulapati, R. (2009). Comparing dynamic and stationary standing postures in an assembly task. *International Journal of Industrial Ergonomics*, *39*(5), 649-654.

Barnes, P. M., Bloom, B., & Nahin, R. L. (2008). Complementary and alternative medicine use among adults and children; United States, 2007. DHHS Publication; no. (PHS) 2009-1250). Washington, DC: U.S. Government Printing Office.

Bastani, F., Hidarnia, A., Kazemnejad, A., Vafaei, M., & Kashanian, M. (2005). A randomized controlled trial of the effects of applied relaxation training on

reducing anxiety and perceived stress in pregnant women. *Journal of Midwifery & Women's Health*, *50*(4), e36-e40.

Bellingrath, S., Weigl, T., & Kudielka, B. M. (2009). Chronic work stress and exhaustion is associated with higher allostastic load in female school teachers: Original research report. *Stress*, *12*(1), 37-48.

Bliese, P. (2016). Multilevel modeling in R (2.6). *Retrieved January 20*, 2020. http://rsync.udc.es/CRAN/doc/contrib/Bliese_Multilevel.pdf.

Bollen, K., & Lennox, R. (1991). Conventional wisdom on measurement: A structural equation perspective. *Psychological Bulletin, 110*(2), 305.

Boyd, C., Crawford, C., Paat, C. F., Price, A., Xenakis, L., Zhang, W., & Evidence for Massage Therapy (EMT) Working Group. (2016). The impact of massage therapy on function in pain populations—A systematic review and meta-analysis of randomized controlled trials: Part III, surgical pain populations. *Pain Medicine*, *17*(9), 1757-1772.

Brown, T. A., Chorpita, B. F., Korotitsch, W., & Barlow, D. H. (1997). Psychometric properties of the Depression Anxiety Stress Scales (DASS) in clinical samples. *Behaviour Research and Therapy*, *35*(1), 79-89.

Bureau of Labor Statistics. (2014). Economic News Release: Nonfatal Occupational Injuries and Illnesses Requiring Days Away From Work, 2013. Retrieved from http://www.bls.gov/news.release/osh2.nr0.htm.

Byers, D.C. (2001). *Better health with foot reflexology: The Ingham method of reflexology* (Rev. ed.). Saint Petersburg, FL: Ingham.

Chalder, T., Berelowitz, G., Pawlikowska, T., Watts, L., Wessely, S., Wright, D., & Wallace, E. P. (1993). Development of a fatigue scale. *Journal of Psychosomatic Research, 37*(2), 147-153.

Cham, R., & Redfern, M. S. (2001). Effect of flooring on standing comfort and fatigue. *Human Factors*, *43*(3), 381-391.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 385-396.

Demerouti, E., Bakker, A. B., Nachreiner, F., & Schaufeli, W. B. (2001). The job demands-resources model of burnout. *Journal of Applied Psychology, 86*(3), 499-512.

De Vries, J., Michielsen, H. J., & Van Heck, G. L. (2003). Assessment of fatigue among working people: a comparison of six questionnaires. *Occupational and Environmental Medicine*, *60*(1), i10-i15.

Diamantopoulis, A. & Winklhofer, H. M. (2001). Index construction with formative indicators: An alternative to scale development. *Journal of Marketing Research, 38*, 269-277.

Dianat, I., Bazazan, A., Azad, M. A. S., & Salimi, S. S. (2018). Work-related physical, psychosocial and individual factors associated with musculoskeletal symptoms among surgeons: Implications for ergonomic interventions. *Applied Ergonomics, 67*, 115-124.

Drury, C. G., Hsiao, Y. L., Joseph, C., Joshi, S., Lapp, J., & Pennathur, P. R. (2008). Posture and performance: Sitting vs. standing for security screening. *Ergonomics*, *51*(3), 290-307.

Engert, V., Kok, B. E., Puhlmann, L. M., Stalder, T., Kirschbaum, C., Apostolakou, F., ... & Singer, T. (2018). Exploring the multidimensional complex systems structure of the stress response and its relation to health and sleep outcomes. *Brain, Behavior, and Immunity*, *73*, 390-402.

Gambles, M., Crooke, M., & Wilkinson, S. (2002). Evaluation of a hospice based reflexology service: a qualitative audit of patient perceptions. *European Journal of Oncology Nursing*, *6*(1), 37-44.

Ganster, D. C., & Rosen, C. C. (2013). Work stress and employee health: A multidisciplinary review. *Journal of Management*, *39*(5), 1085-1122.

Garcia, M. G., Läubli, T., & Martin, B. J. (2015). Long-term muscle fatigue after standing work. *Human Factors*, *57*(7), 1162-1173.

Gierk, B., Kohlmann, S., Kroenke, K., Spangenberg, L., Zenger, M., Brähler, E., & Löwe, B. (2014). The somatic symptom scale–8 (SSS-8): a brief measure of somatic symptom burden. *JAMA Internal Medicine*, *174*(3), 399-407.

Haghighi, M., & Gerber, M. (2019). Does mental toughness buffer the relationship between perceived stress, depression, burnout, anxiety, and sleep?. *International Journal of Stress Management*, *26*(3), 297.

Halim, I., Omar, A. R., Saman, A. M., & Othman, I. (2012). Assessment of muscle fatigue associated with prolonged standing in the workplace. *Safety and Health at Work*, *3*(1), 31-42.

Hassan, O. M., & Bayomy, H. (2015). Occupational respiratory and musculoskeletal symptoms among Egyptian female hairdressers. *Journal of Community Health*, *40*(4), 670-679.

Hodgson, H. (2000). Does reflexology impact on cancer patients' quality of life?. *Nursing Standard (through 2013)*, *14*(31), 33.

Houtman, I. L., Bongers, P. M., Smulders, P. G., & Kompier, M. A. (1994). Psychosocial stressors at work and musculoskeletal problems. *Scandinavian Journal of Work, Environment & Health*, 139-145.

Jorgensen, K., Hansen, L., Lundager, K., & Winkel, J. (1993). Low back muscle reactions to constrained standing in relation to shock absorbing properties of floor and shoes. In R. Nielsen & K. Jorgesen, (Eds.), *Advances in Industrial Ergonomics and Safety V* (341-346). Boca Raton, FL: Taylor & Francis.

Juster, R. P., McEwen, B. S., & Lupien, S. J. (2010). Allostatic load biomarkers of chronic stress and impact on health and cognition. *Neuroscience & Biobehavioral Reviews*, *35*(1), 2-16.

Kristjansson, S. D., Kircher, J. C., & Webb, A. K. (2007). Multilevel models for repeated measures research designs in psychophysiology: An introduction to growth curve modeling. *Psychophysiology*, *44*(5), 728-736.

Kroenke, K., Spitzer, R. L., & Williams, J. B. (2002). The PHQ-15: Validity of a new measure for evaluating the severity of somatic symptoms. *Psychosomatic Medicine*, *64*(2), 258-266.

Kuorinka, I., Jonsson, B., Kilbom, A., Vinterberg, H., Biering-Sørensen, F., Andersson, G., & Jørgensen, K. (1987). Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. *Applied Ergonomics*, *18*(3), 233-237.

Lee, E. H. (2012). Review of the psychometric evidence of the perceived stress scale. *Asian Nursing Research*, *6*(4), 121-127.

Li, W., Zhang, J. Q., Sun, J., Ke, J. H., Dong, Z. Y., & Wang, S. (2007). Job stress related to glyco-lipid allostatic load, adiponectin and visfatin. *Stress and Health: Journal of the International Society for the Investigation of Stress*, *23*(4), 257-266.

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy*, *33*(3), 335-343.

Maestas, N., Mullen, K. J., Powell, D., von Wachter, T., and Wenger, J. B. (2017). Working conditions in the United States: Results of the 2015 American Working Conditions Survey. Santa Monica, CA: RAND Corporation, 2017. https://www.rand.org/pubs/research_reports/RR2014.html.

Marquardt, H., & Myint, N. W. (2011). *Reflex zone therapy of the feet: A comprehensive guide for health professionals.* Healing Arts Press.

Mauss, D., Jarczok, M. N., & Fischer, J. E. (2016). The streamlined allostatic load index: A replication of study results. *Stress*, *19*(6), 553-558.

McEwen, B. S., & Stellar, E. (1993). Stress and the individual: mechanisms leading to disease. *Archives of Internal Medicine*, *153*(18), 2093-2101.

Melzack, R. (1999). From the gate to the neuromatrix. *Pain*, *82*, S121-S126.

Messing, K., Tissot, F., & Stock, S. R. (2006). Lower limb pain, standing, sitting and walking: the importance of freedom to adjust one's posture. In Proceedings of the 16th Congress of the International Ergonomics Association, Maastricht, Netherlands [CD-ROM]. Amsterdam, The Netherlands: Elsevier.

Mussi, G., & Gouveia, N. (2008). Prevalence of work-related musculoskeletal disorders in Brazilian hairdressers. *Occupational Medicine*, *58*(5), 367-369.

National Research Council. (2001). *Musculoskeletal disorders and the workplace: low back and upper extremities*. National Academies Press.

Querstret, D., Cropley, M., & Fife-Schaw, C. (2017). Internet-based instructor-led mindfulness for work-related rumination, fatigue, and sleep: Assessing facets of mindfulness as mechanisms of change. A randomized waitlist control trial. *Journal of Occupational Health Psychology*, *22*(2), 153.

Oleson, T., & Flocco, W. (1993). Randomized controlled study of premenstrual symptoms treated with ear, hand, and foot reflexology. *Obstetrics & Gynecology, 82*(6), 906-911.

Orlando, A. R., & King, P. M. (2004). Relationship of demographic variables on perception of fatigue and discomfort following prolonged standing under various flooring conditions. *Journal of Occupational Rehabilitation, 14*(1), 63-76.

Osman, A., Wong, J. L., Bagge, C. L., Freedenthal, S., Gutierrez, P. M., & Lozano, G. (2012). The depression anxiety stress Scales—21 (DASS□21): further examination of dimensions, scale reliability, and correlates. *Journal of Clinical Psychology*, *68*(12), 1322-1338.

Paramore, L. C. (1997). Use of alternative therapies: estimates from the 1994 Robert Wood Johnson Foundation national access to care survey. *Journal of Pain and Symptom Management, 13*(2), 83-89.

Pinheiro, J., Bates, D., DebRoy, S., Sarkar, D., R Core Team (2019). _nlme: Linear and Nonlinear Mixed Effects Models_. R package version 3.1-142, <URL: https://CRAN.R-project.org/package=nlme>.

Poole, H., Glenn, S., & Murphy, P. (2007). A randomized controlled study of reflexology for the management of chronic low back pain. *European Journal of Pain, 11*(8), 878-887.

Richardson, K. M., & Rothstein, H. R. (2008). Effects of occupational stress management intervention programs: a meta-analysis. *Journal of Occupational Health Psychology, 13*(1), 69.

Robinson, M. D., & Clore, G. L. (2002). Belief and feeling: evidence for an accessibility model of emotional self-report. *Psychological Bulletin*, *128*(6), 934.

Roelen, C. A., Schreuder, K. J., Koopmans, P. C., & Groothoff, J. W. (2007). Perceived job demands relate to self-reported health complaints. *Occupational Medicine, 58*(1), 58-63.

Scherbaum, C. A., & Ferreter, J. M. (2009). Estimating statistical power and required sample sizes for organizational research using multilevel modeling. *Organizational Research Methods*, *12*(2), 347-367.

Servaes, P., Gielissen, M. F. M., Verhagen, S., & Bleijenberg, G. (2007). The course of severe fatigue in disease□free breast cancer patients: a longitudinal study. *Psycho□Oncology: Journal of the Psychological, Social and Behavioral Dimensions of Cancer*, *16*(9), 787-795.

Stephenson, N. L., & Dalton, J. A. (2003). Using reflexology for pain management: a review. *Journal of Holistic Nursing, 21*(2), 179-191.

Stephenson, N. L., Swanson, M., Dalton, J., Keefe, F. J., & Engelke, M. (2007). Partner-delivered reflexology: Effects on cancer pain and anxiety. *Oncology Nursing Forum, 34*(1), 127-132.

Stephenson, N. L., Weinrich, S. P., & Tavakolil, A. S. (2000). The effects of foot reflexology on anxiety and pain in patients with breast and lung cancer. *Oncology Nursing Forum, 27*(1), 67-76.

Stone, P. M. (2011). *Therapeutic reflexology: A step-by-step guide to professional competence*. New York, NY: Pearson.

Su, D. & Li, L. (2011). Trends in the use of complementary and alternative medicine in the United States: 2002–2007. *Journal of Health Care for the Poor and Underserved, 22*(1), 296-310.

Sun, J., Wang, S., Zhang, J. Q., & Li, W. (2007). Assessing the cumulative effects of stress: The association between job stress and allostatic load in a large sample of Chinese employees. *Work & Stress*, *21*(4), 333-347

Szabó, M. (2011). The emotional experience associated with worrying: anxiety, depression, or stress?. *Anxiety, Stress, & Coping*, *24*(1), 91-105.

Taylor, S. E., Repetti, R. L., & Seeman, T. (1997). Health psychology: What is an unhealthy environment and how does it get under the skin?. *Annual Review of Psychology*, *48*(1), 411-447.

Teagarden, K. (n.d.). *What can I expect in a first reflexology visit?* Taking Charge of Your Health and Wellbeing (University of Minnesota Center for Spirituality & Healing). https://www.takingcharge.csh.umn.edu/what-can-i-expect-first-reflexology-visit

Thomas, K., Nicholl, J. P., & Coleman, P. (2001). Use and expenditure on complementary medicine in England: A population based survey. *Complementary Therapies in Medicine. 9*, 2-11.

Thorsteinsson, E. B., Brown, R. F., & Owens, M. T. (2019). Modeling the effects of stress, anxiety, and depression on rumination, sleep, and fatigue in a nonclinical sample. *The Journal of Nervous and Mental Disease, 207*(5), 355-359.

Thorsteinsson, E. B., Brown, R. F., & Richards, C. (2014). The relationship between work-stress, psychological stress and staff health and work outcomes in office workers. *Psychology*, *2014*.

Tsay, S. L., Chen, H. L., Chen, S. C., Lin, H. R., & Lin, K. C. (2008). Effects of reflexotherapy on acute postoperative pain and anxiety among patients with digestive cancer. *Cancer Nursing*, *31*(2), 109-115.

Vardanjani, M. M., Alavi, N. M., Razavi, N. S., Aghajani, M., Azizi-Fini, E., & Vaghefi, S. M. (2013). A randomized-controlled trial examining the effects of reflexology on anxiety of patients undergoing coronary angiography. *Nursing and Midwifery Studies*, *2*(3), 3.

Vincent, C., & Furnham, A. (1996). Why do patients turn to complementary medicine? An empirical study. *British Journal of Clinical Psychology, 35*(1), 37-48.

von Thiele, U., Lindfors, P., & Lundberg, U. (2006). Self-rated recovery from work stress and allostatic load in women. *Journal of Psychosomatic Research*, *61*(2), 237-242.

Waters, T. R., & Dick, R. B. (2015). Evidence of health risks associated with prolonged standing at work and intervention effectiveness. *Rehabilitation Nursing*, *40*(3), 148-165.

Wilkinson, S., Lockhart, K., Gambles, M., & Storey, L. (2008). Reflexology for symptom relief in patients with cancer. *Cancer Nursing*, *31*(5), 354-360.

Winwood, P. C., Lushington, K., & Winefield, A. H. (2006). Further development and validation of the Occupational Fatigue Exhaustion Recovery (OFER) scale. *Journal of Occupational and Environmental Medicine, 48,* 381–389.

Yusufov, M., Nicoloro-SantaBarbara, J., Grey, N. E., Moyer, A., & Lobel, M. (2019). Meta-analytic evaluation of stress reduction interventions for undergraduate and graduate students. *International Journal of Stress Management*, *26*(2), 132.

Zijlema, W. L., Stolk, R. P., Löwe, B., Rief, W., White, P. D., & Rosmalen, J. G. (2013). How to assess common somatic symptoms in large-scale studies: a systematic review of questionnaires. *Journal of Psychosomatic Research*, *74*(6), 459-468.

Table 1

Cronbach's alpha values for focal measures at each study time point.

Survey	Measure				
	Anxiety	Fatigue (1)	Fatigue (2)	MSS	Stress
Pre T1	0.71	0.77	0.74	0.55	0.86
Pre T2	0.81	0.60*	0.70	0.83	0.86**
Inter T3	0.75	0.86	0.83	0.80	0.82*
Inter T4	0.78	0.88	0.89	0.83	0.87
Post1 T5	0.79	0.85	0.86	0.85	0.88
Post T6	0.89	0.89	0.89	0.87	0.90

Note. Fatigue (1) indicates scores from the first fatigue measure; Fatigue (2) indicates scores from the second fatigue measure. * indicates one item in scale was negatively correlated with scale. ** indicates two items in scale were negatively correlated with scale.

Table 2

Means, standard deviations, and correlations with confidence intervals for focal variables at pre-test.

Variable	*M*	*SD*	1	2	3	4
1. Anxiety Pre	0.76	0.52				
2. Fatigue (1) Pre	3.79	0.53	.50** [.18, .73]			
3. Fatigue (2) Pre	3.81	0.64	.16 [-.21, .48]	.36* [.00, .63]		
4. MSS Pre	2.17	0.68	.31 [-.05, .60]	.39* [.05, .66]	.65** [.39, .82]	
5. Stress Pre	1.63	0.48	.53** [.22, .75]	.29 [-.07, .59]	.24 [-.12, .55]	.02 [-.34, .37]

Note. M and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). Fatigue (1) indicates scores from the first fatigue measure; Fatigue (2) indicates scores from the second fatigue measure. * indicates $p < .05$. ** indicates $p < .01$.

Table 3

Correlations between variables across pre-test and intervention time points.

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Condition	0.48	0.51															
2. Anxiety Pre	0.76	0.52	-.11														
3. Anxiety T1	0.69	0.51	.17	.72**													
4. Anxiety T2	0.53	0.47	.19	.66**	.78**												
5. Fatigue Pre	3.79	0.53	-.23	.50**	.34	.19											
6. Fatigue T1	3.38	0.69	.23	.31	.40*	.42*	.49**										
7. Fatigue T2	3.05	0.83	.11	.43*	.52**	.70**	.01	.42*									
8. Fatigue2 Pre	3.81	0.64	-.13	.16	.00	.08	.36*	.38*	.18								
9. Fatigue2 T1	3.32	0.88	.22	.30	.27	.52**	.22	.69**	.33	.44*							
10. Fatigue2 T2	3.08	1.10	.03	.27	.28	.49**	.02	.36*	.65**	.60**	.60**						
11. MSS Pre	2.17	0.68	-.01	.31	.33	.40*	.39*	.45*	.36*	.65**	.50**	.57**					
12. MSS T1	1.66	0.87	.34	.30	.45*	.51**	.14	.61**	.33	.49**	.81**	.65**	.64**				
13. MSS T2	1.37	0.90	.12	.17	.26	.39*	.09	.47**	.41*	.60**	.72**	.86**	.66**	.80**			
14. Stress Pre	1.63	0.48	-.18	.53**	.29	.24	.43*	.12	.23	-.13	-0.06	.01	.02	-.13	-.15		
15. Stress T1	1.66	0.54	-.14	.26	.39*	.29	.39*	.45*	.34	.00	.11	.23	.22	.09	.12	.62**	
16. Stress T2	1.54	0.65	-.03	.40*	.48**	.39*	.22	.17	.61**	-.16	-.04	.32	.15	-.01	.07	.65	.63**

Note. M and *SD* are used to represent mean and standard deviation, respectively. * indicates $p < .05$. ** indicates $p < .01$.

Table 4

Means and standard deviations for outcome variables over time between groups.

	Reflexology (n = 15)	Relaxation (n = 16)
Outcome Measures	Mean (SD)	Mean (SD)
Anxiety		
Pre-test	0.70 (0.55)	0.82 (0.49)
Inter T2	0.78 (0.65)	0.61 (0.34)
Inter T3	0.62 (0.50)	0.45 (0.44)
Post T4	0.63 (0.56)	0.57 (0.56)
Post T5	0.87 (0.82)	0.45 (0.50)
Fatigue (1)		
Pre-test	3.66 (0.52)	3.90 (0.53)
Inter T2	3.54 (0.63)	3.23 (0.72)
Inter T3	3.15 (0.91)	2.96 (0.77)
Post T4	3.19 (0.77)	2.97 (0.69)
Post T5	3.27 (1.01)	2.93 (0.84)
Fatigue (2)		
Pre-test	3.73 (0.66)	3.89 (0.64)
Inter T2	3.52 (0.89)	3.14 (0.97)
Inter T3	3.12 (1.13)	3.05 (1.10)
Post T4	2.93 (1.06)	3.05 (1.06)
Post T5	3.10 (1.15)	3.14 (1.09)
MSS		
Pre-test	2.16 (0.72)	2.17 (0.66)
Inter T2	1.96 (0.90)	1.39 (0.77)
Inter T3	1.49 (0.96)	1.27 (0.86)
Post T4	1.49 (1.09)	1.34 (0.91)
Post T5	1.84 (1.17)	1.52 (0.87)
Stress		
Pre-test	1.55 (0.47)	1.71 (0.49)
Inter T2	1.59 (0.58)	1.73 (0.51)
Inter T3	1.52 (0.77)	1.56 (0.54)
Post T4	1.51 (0.64)	1.38 (0.66)
Post T5	1.54 (0.78)	1.46 (0.93)

Note. N = 31. Fatigue (1) indicates scores from the first fatigue measure; Fatigue (2) indicates scores from the second fatigue measure.

Table 5

Growth curve model results for outcome variables from pre-test through intervention time points 1 and 2.

Variable	Coefficient	Std. Error	df	t-value	p-value
Anxiety					
1. Intercept	0.82	0.13	60	6.32	0.00
2. Time	-0.19	0.05	60	-3.82	0.00
3. Condition	-0.08	0.19	29	-0.42	0.68
4. Time*Condition	0.15	0.07	60	2.05	0.05
Fatigue (1)					
1. Intercept	3.86	0.15	60	26.51	0.00
2. Time	-0.47	0.12	60	-3.85	0.00
3. Condition	-0.17	0.21	29	-0.79	0.47
4. Time*Condition	0.22	0.18	60	1.23	0.31
Fatigue (2)					
1. Intercept	3.76	0.15	60	24.37	0.00
2. Time	-0.42	0.11	60	-3.75	0.00
3. Condition	0.00	0.22	29	0.01	0.99
4. Time*Condition	0.12	0.16	60	0.72	0.48
MSS					
1. Intercept	2.02	0.16	59	12.32	0.00
2. Time	-0.41	0.08	59	-4.89	0.00
3. Condition	-0.24	0.24	29	-0.99	0.33

4.	Time*Condition	0.03	0.13	59	0.24	0.81
Stress						
1.	Intercept	1.75	0.12	60	15.19	0.00
2.	Time	-0.07	0.06	60	-1.18	0.24
3.	Condition	-0.18	0.17	29	-1.09	0.28
4.	Time*Condition	0.06	0.09	60	0.67	0.50

Note. N = 31. Time variable consists of the pre-test composite score of both pre-test time points, the first intervention time point, and the second intervention time point. Intercept value for each outcome measure reflects value at pre-test averaged across the two intervention groups. Fatigue (1) indicates scores from the first fatigue measure; Fatigue (2) indicates scores from the second fatigue measure.

Table 6

Growth curve model results for outcome variables from pre-test through intervention time points 1 and 2, and the first post-test time point (one-week post-intervention).

Variable	Coefficient	Std. Error	df	t-value	p-value
Anxiety					
5. Intercept	0.76	0.13	90	5.87	0.00
6. Time	-0.09	0.05	90	-1.89	0.06
7. Condition	-0.04	0.19	29	-0.19	0.85
8. Time*Condition	0.05	0.06	90	0.83	0.41
Fatigue (1)					
5. Intercept	3.76	0.15	90	25.13	0.00
6. Time	-0.30	0.08	90	-3.80	0.00
7. Condition	-0.20	0.22	29	-0.55	0.59
8. Time*Condition	0.14	0.11	90	1.18	0.24
Fatigue (2)					
5. Intercept	3.68	0.17	90	21.92	0.00
6. Time	-0.27	0.08	90	-3.49	0.00
7. Condition	0.06	0.24	29	0.26	0.80
8. Time*Condition	-0.001	0.11	90	-0.05	0.96
MSS					
5. Intercept	1.94	0.17	89	11.25	0.00
6. Time	-0.26	0.07	89	-3.87	0.00
7. Condition	0.24	0.26	29	0.95	0.35

8.	Time*Condition	0.00	0.10	89	0.02	0.98
Stress						
5.	Intercept	1.77	0.12	90	15.18	0.00
6.	Time	-0.11	0.04	90	-2.59	0.01
7.	Condition	-0.20	0.17	29	-1.19	0.24
8.	Time*Condition	0.09	0.06	90	1.47	0.15

Note. N = 31. Time variable consists of the pre-test composite score of both pre-test time points, the first intervention time point, the second intervention time point, and the first post-test time point. Fatigue (1) indicates scores from the first fatigue measure; Fatigue (2) indicates scores from the second fatigue measure.

Table 7

Growth curve model results for outcome variables from pre-test through intervention time points 1 and 2, and the second post-test time point (two weeks post-intervention).

Variable	Coefficient	Std. Error	df	t-value	p-value
Anxiety					
9. Intercept	0.77	0.13	89	6.01	0.00
10. Time	-0.12	0.05	89	-2.62	0.01
11. Condition	-0.00	0.18	29	-0.42	0.67
12. Time*Condition	0.17	0.07	89	2.45	0.02
Fatigue (1)					
9. Intercept	3.78	0.14	88	26.77	0.00
10. Time	-0.32	0.09	88	-3.41	0.00
11. Condition	-0.15	0.20	29	-0.73	0.47
12. Time*Condition	0.19	0.13	88	1.40	0.17
Fatigue (2)					
9. Intercept	3.67	0.17	88	21.94	0.00
10. Time	-0.24	0.09	88	-2.86	0.00
11. Condition	0.03	0.24	29	0.14	0.89
12. Time*Condition	0.02	0.12	88	0.14	0.89
MSS					
9. Intercept	1.93	0.20	88	9.51	0.00
10. Time	-0.21	0.09	88	-2.23	0.03
11. Condition	0.20	0.30	29	0.67	0.51

12. Time*Condition	0.06	0.14	88	0.44	0.66
Stress					
9. Intercept	1.76	0.14	89	12.81	0.00
10. Time	-0.09	0.06	89	-1.45	0.15
11. Condition	-0.20	0.20	29	-1.00	0.38
12. Time*Condition	0.08	0.09	89	0.97	0.34

Note. N = 31. Time variable consists of the pre-test composite score of both pre-test time points, the first intervention time point, the second intervention time point, and the second post-test time point. Fatigue (1) indicates scores from the first fatigue measure; Fatigue (2) indicates scores from the second fatigue measure.

Table 8

Qualitative themes and exemplary quotes during pre-test, intervention and post-test phases of the study.

Pre-test				
During work shifts this week				
Themes	**Subthemes/Codes**	**Count**	**Exemplary Quote**	**Group** (relaxation = 0, reflexology =1)
Pain in legs, feet, back, joints	Foot, leg, back pain	14	"The more I work, the more my feet, legs, and back hurt."	0
	Feet ache	5	"My feet ache very much throughout the shift and tend to be into the the next morning."	0
	Joint pain	3		
	Bodily tenseness	1	"I felt more stressed and tenseness in my legs."	0
Feeling fatigued, tired, exhausted	Exhausted	6	"Mentally and physically exhausted."	0
	Fatigued	3	"Tired, fatigued."	1
	Mentally tired	2		
	Tired	24	"I was tired during the majority of my shifts."	1
Feeling stressed	Stress related to school	2	"Felt tired and stressed due to work and school activities being in the backdrop."	0
	Stress related to work	5	"I have felt very stressed at work and not in control when I was supposed to be."	1
Metaphorical expressions for negative feelings at work	Dragging through water	2	"Dragging myself through water."	0
	Head fog	2	"I felt like my mind was in a fog, and another world."	0
	Puppet	1	"Feeling like a puppet being pulled."	0
Things were okay or good at work	Felt good at work	4	"I felt good for the most part during the shifts, but afterwards felt very tired."	0
	OK or average at work	6	"This week I felt pretty average at work."	1
Feeling distracted		5	"I caught myself daydreaming at multiple times."	0
Needing to sit, bend, stretch, etc.		2	I had to constantly keep stretching my back."	0
Unmotivated		3	"Unmotivated to finish the shifts but doing it anyways for the money."	0

Outside work shifts this week				
Themes	**Subthemes/Codes**	**Count**	**Exemplary Quote**	**Group** (relaxation = 0, reflexology =1)
Pain in legs, feet, back, joints		3	"The days after working, my legs, feet, and back hurt for a couple of days."	0
Feeling fatigued, tired, exhausted	Exhausted	3	"Physically and mentally exhausted from school and trying to balance out school and work to pay bills."	1
	Mentally tired	4	"Tired physically and mentally."	1
	Tired	11	"So glad to be off feet and very tired"	1
Feeling stressed	Stress related to school	8	"Stressed about my exams and grades"	0
	Stress related to work	1	"Thinking about work. Upset because of things at work."	1
More positive feelings outside of work	Feel better at home	7	"Less stressed when I'm not at work."	1
	Mental clarity	1	"Mentally feel much clearer and more up beat, but not enthusiastic."	0
	Relaxed	2	"I felt more relaxed not being at work and was able to focus more on my homework"	1
Neutral		1	"Physically neutral."	1
Needing to sit, bend, stretch, etc.		1	"Still very tired, but spent time sitting down to ease the back and feet pain that has built up."	0
Unmotivated		1	"I wasn't physically feeling like my usual self, I didn't have much of a desire to work out like I usually do."	

Intervention				
During relaxation sessions this week				
Themes	**Subthemes/Codes**	**Count**	**Exemplary Quote**	**Group** (relaxation = 0, reflexology =1)
Difficulties or nervousness associated with the sessions	Could not relax	4	"I was definitely trying to relax as much as possible, but I kept thinking about things I had to do when I got back to my apartment, and all the work and assignments I had to get done before work."	0
	Difficult, adjustment	1	"The first relaxation session was an adjustment, because I am always moving so fast paced and thinking about what I have to do next that I had to train myself to be in the moment and not think about anything and be calm. It was a little difficult, but the second session was much more relaxing for me because I was able let go of any thoughts I had and just rest."	0
	Nervous, apprehensive	1	"They were very relaxing while at first I was apprehensive and nervous I did learn to relax and enjoy the sessions"	0
	Distracted	5	"It was nice to just sit still for a little although I did find myself thinking about things I had to do after the session"	0
Feeling fatigued or tired	Fatigue, exhaustion	1	"Fatigued, exhausted."	1
	Tired	2		
Pain in legs, feet, back		3	"Back was the main thing that hurt. Feet are sore but my legs didn't hurt much today.	0
Reductions in negative symptoms	Less bodily fatigue	1		
	Less pain	1		
	Less stress	2	"tension-free, less stress, best experience, mind peace."	0
	Less tension	4	"They were very good and were able to relieve some of the tension in my legs and feet; however I feel this is something I would have to do long term to see lasting effects since I'm always on my feet."	1
Meditating/in a meditative state		4	"My relaxing session this week was awesome. I meditated again and dozed off a few times but I felt no immediate pain that following night at work until I stop working. Mentally free of worries and anxiety."	1
Neutral		1		
Sessions were a positive experience			"My relaxation sessions were very nice, I wish there was more of them. I really enjoyed going to them and receiving them."	0
			"I really looked forward to them because it was a segment of my day to just relax. Very positive."	0
		18	"I felt like I was in another world. It was extremely relaxing and calming, it allowed me to take time to myself which is something that I don't usually have time to do."	1
Feeling relaxed		36	"I felt VERY relaxed, my body and mind felt at ease so much that I was able to sleep."	0
			"Very relaxed! Able to completely clear my mind"	1
			"During my relaxation sessions, I felt completely relaxed and almost fell asleep."	1
			"The relaxation sessions were very nice to just take a break from everything and relax. This week was very stressful so I really appreciated a nice quiet break from everything."	1
Sessions felt good		3	"I felt really great both mentally and physically during my sessions this week."	1
Neutral		1	"neutral"	1

After relaxation sessions this week				
Themes	**Subthemes/Codes**	**Count**	**Exemplary Quote**	**Group** (relaxation = 0, reflexology =1)
Pain in legs, feet, back		3	"It was great however this is brought out some of that pain in my heels"	1
Reductions in negative symptoms	Less pain	4	"Better and less pain in the legs"	1
			"My feet felt great and with no pain which was awesome."	1
			"It certainly relieved my aching feet although I struggled to relax my mind."	0
	Less stress	2	"Refreshed and less stressed"	1
	Less tension	5	"Tension released as well as feeling fairly refreshed. Legs and feet feel entirely different as if energy was put back into them."	0
			"Physically, I think the sessions are helping a lot with my muscle tension that I've always had. When I wake up in the mornings, sometimes I stretch my body to be as long as possible and I'll catch a cramp in one of my calves. That hasn't really happened this week. Also when I would get up to walk, there would be uncomfortable tension in my Achilles and I would have to stretch it out. That also hasn't happened a lot lately."	1
	Less tired	2	"after the session, I felt less tired and more meditated"	0
Positive outcomes	Increased circulation	2	"My legs and feet felt like they had more circulation as well."	0
	Relaxed, calm	24	"I felt very calm after"	1
			"Better. Felt relaxed and calm."	0
			"Mentally, the sessions allow me to decompress from class and relax without thinking about homework, tests or work."	1
			"I felt completely at ease mentally and ready to take on the rest of the week. It really centered my thoughts and I didn't feel as anxious about upcoming tasks."	0
	Feeling refreshed, more energy	18	"I felt refreshed and new."	0
			"Physically: I was kind of engersied for whole day and I wasn't feeling drowsy for rest of the day after the session."	0
		13	"My mental and physical state was much better after my relaxation sessions this week."	0
Sessions were a positive experience generally			"It definitely had a positive impact to the rest of my day. I lead the day feeling more relaxed and confident."	0
			"It was relatively better. On a per day basis, it was enjoyable to have a day to look forward to. Speaking for the whole week, not too impactful, still a lot on my plate, but if this were a consistent occurrence, I'd have something to look forward to."	0
			"I felt like last week - as if I had hit a restart button and was suddenly ready to take on everything. It was most beneficial mentally, but physically I also felt better than before the relaxation sessions. I want to continue doing something similar to the relaxation sessions, because they were so beneficial to me physically and mentally."	0
More focused		5	"I was able to focus better after my sessions this week."	1
Positive outcomes did not last		6	"Mental state and physical state was great immediately after the session, but faded as time passed (about 1 day)."	0
			"A bit relaxed but it was short-lived"	1
Improved mood, attitude		7	"Much happier and energized. I was more accepting to the fact that I had to go to work which made me start my day with a more positive attitude."	0
			"I felt really happy and relaxed after these sessions."	1
No difference		2	"Same as usual."	1
Negative effects	Negative effects generally	2	"It also brings out some of the pain that may have been buried under the tense muscles but overall I felt good and relaxed."	1
	Tired	2	"I felt a little more drowsy."	0

During work shifts this week				
Themes	**Subthemes/Codes**	**Count**	**Exemplary Quote**	**Group** (relaxation = 0, reflexology =1)
Distracted/difficulty concentrating		7	"Mentally I had a lot of things going on in my mind."	0
Pain in legs, feet, back		23	"pain in feet and back. aches in legs"	1
Reductions in negative symptoms	Less fatigue	6	"General fatigue was much less than previous weeks."	0
	Less pain	19	"My legs and feet didn't hurt as bad as usual."	0
	Less stressed	3	"Felt less stressed"	1
	Less tension	1	"physically less tension and pain throughout lower body."	0
	Less tired	4	"I felt pretty energized I wasn't as tired as I had been previously at work."	1
Feeling fatigued or tired	Fatigued, exhausted	1		
	Tired	35	"I was both physically and mentally tired."	0
Feel good generally	Felt good	11	"I felt good during my shifts this week. Both physically and mentally I felt prepared for the tasks at hand."	0
	Good mood	7	"A little unfocused but in a great mood."	1
	Felt better mentally	2	"Mentally I was more on top of things than usual."	0
Better focus or concentration		6	"I could concentrate more because my feet were not hurting as much."	1
Positive outcomes	More energy		"More energetic than usual."	0
		10	"I was more energetic than I have been normally and have felt I was more productive."	0
	Feeling calm, relaxed	4	"I felt better mentally. I was calmer, more easy-going."	0
No difference or neutral	Same, no difference	3	"Physically was the same"	0
	Neutral	5	"neutral"	1
Needed to sit, bend, stretch, etc.		2	"During work today, my feet and my back hurt a lot, and I had to sit and rest more than usual."	1
Was sick		4		
More productive		4	"Have felt I was more productive."	0
Stress, burnout	Burnout	3	"I felt motivated to get my tasks completed but I felt sad and burnt-out doing the same thing over and over again."	1
	Stressed	22	"I was tired and worried about end of semester project deadlines. It was always in the back onf my mind while I worked"	0

Outside of work shifts this week				
Themes	**Subthemes/Codes**	**Count**	**Exemplary Quote**	**Group** (relaxation = 0, reflexology =1)
Pain in legs, feet, back		3	"I felt very relaxed although the foot pain persisted."	0
Reductions in negative symptoms	Less pain	8	"I felt less soreness."	1
	Less stressed	6	"I felt very tired, but not stressed."	0
Feeling fatigued or tired	Fatigued	1	"Fatigued, but not aching."	0
	Tired	10	"Physically tired, mentally tired."	1
Felt better generally	Felt better generally	6	"When I was not at work I felt better than usual."	0
	Good or improved mood	7	"In a better mood than usual."	1
Busy		4	"Tired, and busy."	0
Focused		5	"Calm, focused, determined."	1
Positive outcomes	Good sleep	1		
	More energy	7	"I felt more energized."	1
	Relaxed, calm	14	"When I wasn't at work, I was actually calm and relaxed."	1
Was sick		1		
Stressed		8	"Stressed over school and other responsibilities."	1
No difference or neutral	Same, no difference	1		
	Neutral	1	"I was fine, not happy or sad just fine."	1
Bad mood		1		

Post-test				
During work shifts this week				
Themes	**Subthemes/Codes**	**Count**	**Exemplary Quote**	**Group** (relaxation = 0, reflexology =1)
Concentration	Distracted	7	"With finals due this week, couldn't focus on work a lot."	0
	Better concentration	1	"Concentrated for much longer periods than usual.:	0
Pain in legs, feet, back		10	"My legs and feet were hurting a lot."	0
Feeling fatigued or tired	Fatigued	3	"Extremely exhausted mentally and physically."	0
	Tired	18	"I was so tired at work yesterday. It was really busy, so my body was so tired during and after work."	1
Stress, burnout	Burnout	1		
	Stressed	1	"Work was stressful last week because I had a lot on my mind for work and home."	1
Reductions in negative symptoms	Less pain	4	"I have been able to get through the day without acknowledging my feet pain."	0
	Less stress	1		
Feeling better was surprising or unusual		2	"Overall I was not yearning for a rest during my work shift which was unusual for me."	0
Positive outcomes	Energetic	3	"Energetic both physically and mentally!"	1
	Relaxed	3		
	Felt good or better generally	3	"I have felt better physically and mentally this week."	1
Positive outcomes did not last		1	"At the beginning I was feeling fine but as the week went on it slowly wore me down and slowly causing more and more pain in my feet."	0
Feeling confident		1		
Better time at work	Easier time at work	4	"Pretty good its been a slow week so i havent had to strain physically"	0
	Job task changed	1		
	Engaged	6	"Physically and mentally there. I was able to be attentive and cordial without faking it this week."	0
Feeling confident		1		

Needed to sit, bend, etc.		1	"...found it difficult to avoid trying to sit down for any period."	0
Nervous or anxious	Related to school shooting	1		
Overwhelmed		2	"Mentally- My mental state has been tested all week from the end of semester exams work to people calling me asking for help on a variety of task. My mind is all over the place which does not help when I just want to get some rest."	0
Neutral		5	"My work shifts were fine."	1

Outside of work shifts this week

Themes	**Subthemes/Codes**	**Count**	**Exemplary Quote**	**Group** (relaxation = 0, reflexology =1)
Pain in legs, feet, back		4	"The day after work, I had severe leg and feet pain."	0
Feeling fatigued or tired	Fatigued	1		
	Tired	14	"When I wasn't at work I felt a bit drowsy and tired."	0
	Trouble sleeping	1		
Stressed	Stressed	6	"Since finals are coming up, I was relatively stressed."	1
	Overwhelmed	1		
Reductions in negative symptoms	Less pain	2	"Pain throughout body was still greatly reduced compared to initial weeks, especially in feet."	0
	Less tired	1		
	Well-rested	3	"Spring break helped, I felt like I had more time for homework and to rest."	0
Positive outcomes	Energetic	2		
	Refreshed	3	"I felt happy and refreshed."	0
	Things are generally good	3	"Pretty good too. ive been relaxed mentally and physically so its been great	0
	Relaxed, calm	11	"Even more relaxed."	1
Positive outcomes are surprising or unusual		1		
Feeling confident		2	"I felt well rested this week and more confident in my day to day tasks.	0
Metaphorical expressions for negative feelings at work		1	"My head was cloudy."	1
Emotions or feelings	Happy	4	"Happy."	1
Related to school shooting	Upset	1	"Mentally- I been very upset about the shooting and been dealing with it... I guess."	1
	Nervous or anxious	1	"When I was not at work, I was very on edge and nervous because of the shootings. I avoided going anywhere on campus other than sovi and my room."	1
Neutral		2	"Physically I was fine."	0
Unmotivated		3	"No motivation."	0
Actively trying to relax	Trying to relax	1	"When I was not at work I was trying to relax."	1
	Tried to stay off feet	1	"I was still able to relax and tried to stay off my feet to rest them from work"	0

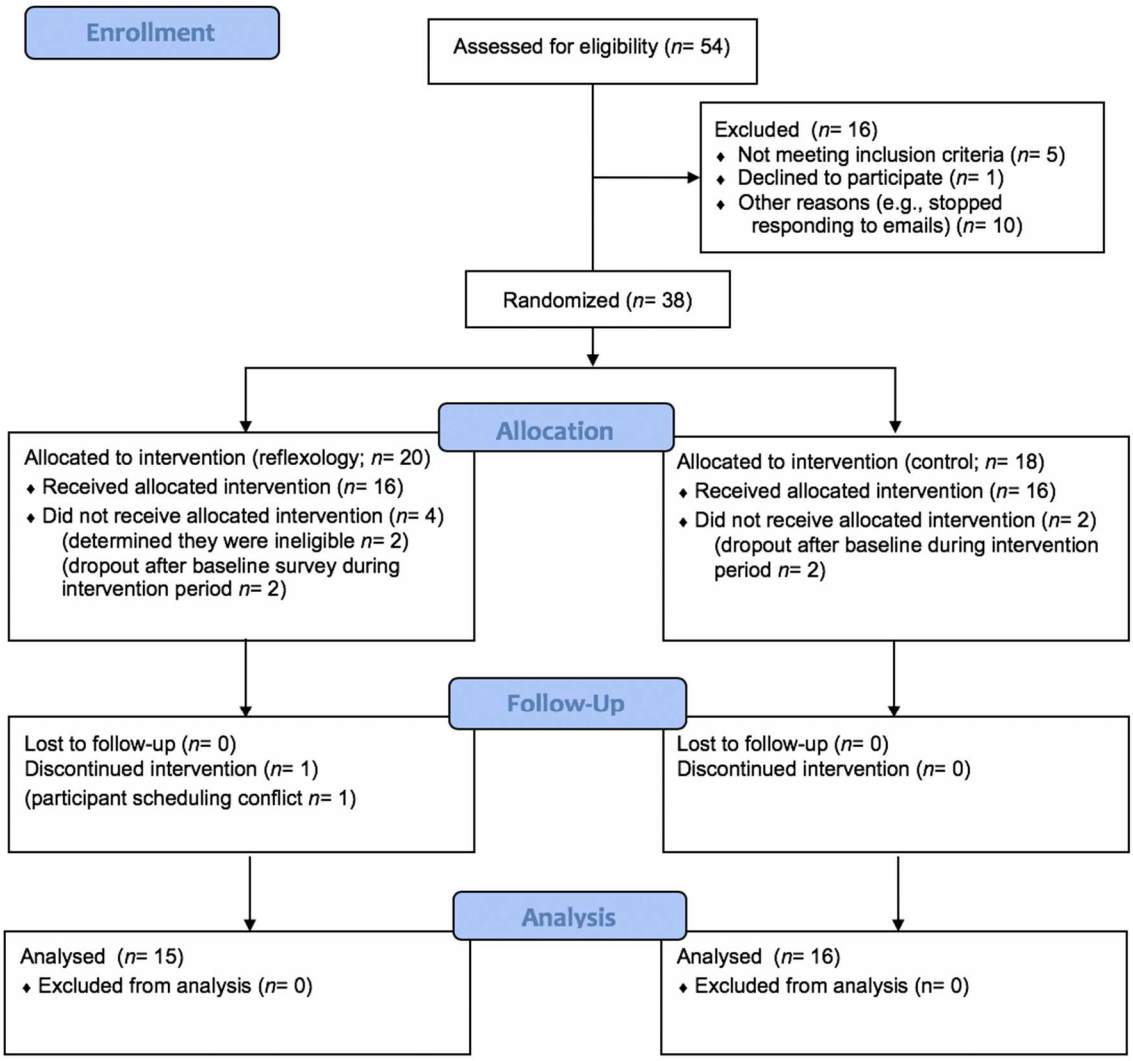

Figure 1. Participant Flow Diagram.

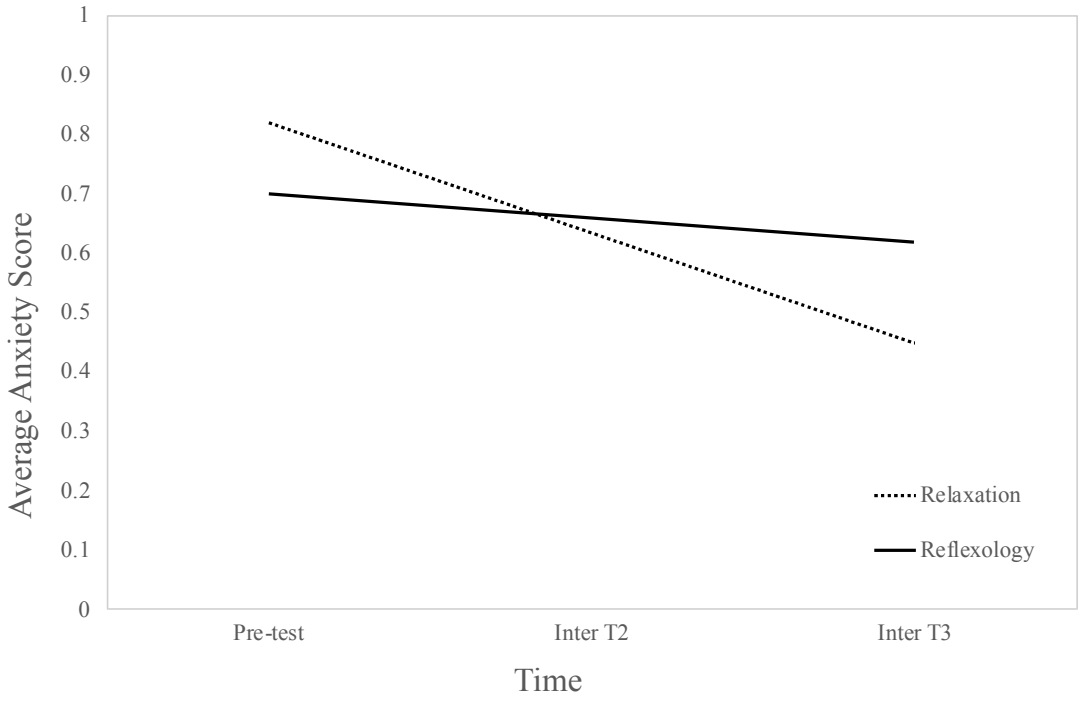

Figure 2. Interaction of Anxiety Scores by Condition over Time (Pre-test through Intervention).

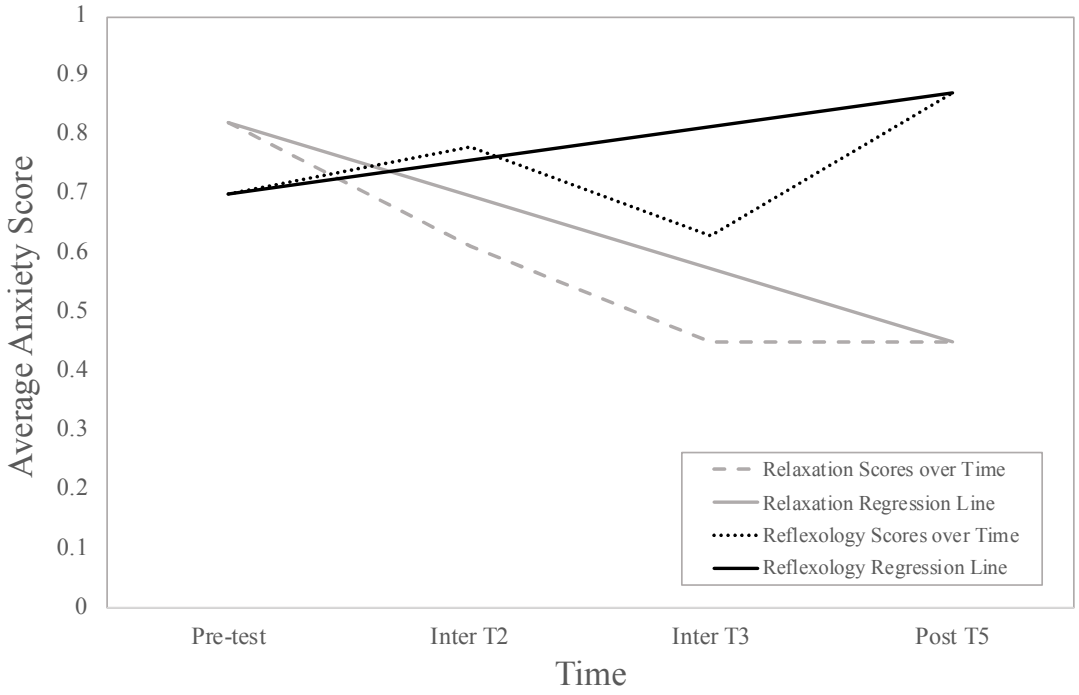

Figure 3. Anxiety Scores by Condition over Time (Pre-test through Intervention, Second Post-test) including Regression Lines involved in Interaction of Time by Condition.

APPENDIX A: LIST OF BASELINE SCALES AND ITEMS

What is your participant ID?

What is your gender?
- Male
- Female
- Genderqueer/non-binary
- Other

What is your age? (text entry)

If you are a student, what is your year in school?
- Freshman
- Sophomore
- Junior
- Senior
- Not applicable

Which category best describes your race? (One or more categories may be marked)
- American Indian/Alaska Native
- Asian
- Black or African American
- Latino/a or Hispanic
- Native Hawaiian/Other Pacific Islander
- White
- Other

How many hours per week do you work on average? (text entry)

Is your current position a paid position or an unpaid position (e.g., unpaid internship)?
- Paid position
- Unpaid position

How many months have you worked in your current organization? (text entry)

What type of job do you work in?
- Retail
- Food service
- Manufacturing
- Office/Administrative
- Other _____ (please fill in)

What percentage of the time on your job do you stand? (text entry)

Does your workplace provide any accommodations for standing (e.g., stool, an ergonomic standing mat, etc.)? If yes, please describe. (text entry)

- Yes | [text entry]
- No

Stress

Scale: Perceived Stress Scale (14 items)

Citation: Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 385-396.

Instructions: The questions in this scale ask you about your feelings and thoughts at work *during the last month*. In each case, please indicate how often you felt or thought a certain way.

Response Scale:

Value	Anchor
0	Never
1	Almost never
2	Sometimes
3	Fairly often
4	Very often

Items:

Item
Been upset because of something that happened unexpectedly
Felt that you were unable to control the important things
Felt nervous and "stressed’
Dealt successfully with irritating work hassles
Felt that you were effectively coping with important changes that were occurring at work
Felt confident about your ability to handle your personal problems while trying to work
Felt that things were going your way
Found that you could not cope with all the things that you had to do
Been able to control irritations
Felt that you were on top of things
Been angered because of things that happened that were outside of your control
Found yourself thinking about things that you have to accomplish
Been able to control the way you spend your time

Felt difficulties were piling up so high that you could not overcome them

Anxiety

Scale: Depression, Anxiety and Stress Scale (DASS) –Anxiety subscale only (7 items)

Citation: Lovibond, S.H. & Lovibond, P.F. (1995). *Manual for the Depression Anxiety Stress Scales*. (2nd. Ed.) Sydney: Psychology Foundation.

Instructions: Please read each statement and rate how much the statement applied to you at work *over the past month*. Do not spend too much time on any statement.

Response Scale:

Value	Anchor
0	Did not apply to me at all
1	Applied to me some of the time
2	Applied to me a good part of the time
3	Applied to me most of the time

Items:

Item
I was aware of dryness of my mouth.
I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion).
I experienced trembling (e.g., in the hands).
I felt that I was using a lot of nervous energy.
I was worried about situations in which I might panic and make a fool of myself.
I felt I was close to panic.
I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat).

Fatigue

Scale: Fatigue Scale (10 items)

Citation: Chalder, T., Berelowitz, G., Pawlikowska, T., Watts, L., Wessely, S., Wright, D., & Wallace, E. P. (1993). Development of a fatigue scale. *Journal of Psychosomatic Research*, *37*(2), 147-153.

Instructions: Please respond indicating how often you have experienced each of the following statements *during the past month.*

Response Scale:

Value	Anchor

1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

Items:

Item
I have had problems with tiredness.
I need to rest more.
I have felt sleepy or drowsy.
I have had problems starting things.
I have been lacking in energy.
I have felt like I had less strength in my muscles.
I have at times felt weak.
I have had difficulty concentrating.
I have made slips of the tongue when speaking.
I have at times found it more difficult to find the right word.

Scale: Fatigue Scale (4 items)

Citation: Researcher-created, based on items from Orlando, A. R., & King, P. M. (2004). Relationship of demographic variables on perception of fatigue and discomfort following prolonged standing under various flooring conditions. *Journal of Occupational Rehabilitation*, *14*(1), 63-76.

Instructions: Please indicate your physical tiredness level *during the past month*.

Response Scale:

Value	Anchor
1	Not tired
2	
3	
4	
5	Very tired

Items:

Item
Please rate your general tiredness level.
Please rate the tiredness level of your legs.
Please rate the tiredness level of your feet.
Please rate the tiredness level of your back.

Musculoskeletal Symptoms

Scale: The Somatic Symptom Scale-8 (SSS-8) (11 items—3 items added to original 8 by researchers)

Citation: Gierk, B., Kohlmann, S., Kroenke, K., Spangenberg, L., Zenger, M., Brähler, E., & Löwe, B. (2014). The somatic symptom scale–8 (SSS-8): a brief measure of somatic symptom burden. *JAMA Internal Medicine*, *174*(3), 399-407.

Instructions: *During the past month*, how much have you been bothered by any of the following problems?

Response Scale:

Value	Anchor
0	Not at all
1	A little bit
2	Somewhat
3	Quite a bit
4	Very much

Items:

Item
Stomach or bowel problems
Back pain
Pain in your arms
Pain in your legs
Pain in your feet
Pain in your joints
Headaches
Chest pain or shortness of breath
Dizziness
Feeling tired or having low energy
Trouble sleeping

APPENDIX B: LIST OF WEEKLY SCALES AND ITEMS

What is your participant ID? (text entry)

When did your most recent work shift end? (date entry)

How many hours did you spend standing during your most recent work shift? (text entry)

Anxiety

Scale: Depression, Anxiety and Stress Scale (DASS) –Anxiety subscale only (7 items)

Citation: Lovibond, S.H. & Lovibond, P.F. (1995). *Manual for the Depression Anxiety Stress Scales*. (2nd. Ed.) Sydney: Psychology Foundation.

Instructions: Please read each statement and rate how much the statement applied to you at work *over the past week*. Do not spend too much time on any statement.

Response Scale:

Value	Anchor
0	Did not apply to me at all
1	Applied to me some of the time
2	Applied to me a good part of the time
3	Applied to me most of the time

Items:

Item
I was aware of dryness of my mouth.
I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion).
I experienced trembling (e.g., in the hands).
I felt that I was using a lot of nervous energy.
I was worried about situations in which I might panic and make a fool of myself.
I felt I was close to panic.
I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat).

Fatigue

Scale: Fatigue Scale (10 items)

Citation: Chalder, T., Berelowitz, G., Pawlikowska, T., Watts, L., Wessely, S., Wright, D., & Wallace, E. P. (1993). Development of a fatigue scale. *Journal of Psychosomatic Research*, *37*(2), 147-153.

Instructions: Please respond indicating how often you have experienced each of the following statements *during the past week.*

Response Scale:

Value	Anchor
1	Strongly disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly agree

Items:

Item
I have had problems with tiredness.
I need to rest more.
I have felt sleepy or drowsy.
I have had problems starting things.
I have been lacking in energy.
I have felt like I had less strength in my muscles.
I have at times felt weak.
I have had difficulty concentrating.
I have made slips of the tongue when speaking.
I have at times found it more difficult to find the right word.

Scale: Fatigue Scale (4 items)

Citation: Researcher-created, based on items from Orlando, A. R., & King, P. M. (2004). Relationship of demographic variables on perception of fatigue and discomfort following prolonged standing under various flooring conditions. *Journal of Occupational Rehabilitation*, *14*(1), 63-76.

Instructions: Please indicate your physical tiredness level *during the past week.*

Response Scale:

Value	Anchor
1	Not tired
2	
3	
4	
5	Very tired

Items:

Item
Please rate your general tiredness level.
Please rate the tiredness level of your legs.
Please rate the tiredness level of your feet.
Please rate the tiredness level of your back.

Musculoskeletal Symptoms

Scale: The Somatic Symptom Scale-8 (SSS-8) (11 items—3 items added to original 8 by researchers)

Citation: Gierk, B., Kohlmann, S., Kroenke, K., Spangenberg, L., Zenger, M., Brähler, E., & Löwe, B. (2014). The somatic symptom scale–8 (SSS-8): a brief measure of somatic symptom burden. *JAMA Internal Medicine*, *174*(3), 399-407.

Instructions: *During the past week*, how much have you been bothered by any of the following problems?

Response Scale:

Value	Anchor
0	Not at all
1	A little bit
2	Somewhat
3	Quite a bit
4	Very much

Items:

Item
Stomach or bowel problems
Back pain
Pain in your arms
Pain in your legs
Pain in your feet
Pain in your joints
Headaches
Chest pain or shortness of breath
Dizziness
Feeling tired or having low energy
Trouble sleeping

Stress

Scale: Perceived Stress Scale (14 items)

Citation: Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 385-396.

Instructions: The questions in this scale ask you about your feelings and thoughts at work *during the past week*. In each case, please indicate how often you felt or thought a certain way.

Response Scale:

Value	Anchor
0	Never
1	Almost never
2	Sometimes
3	Fairly often
4	Very often

Items:

Item
Been upset because of something that happened unexpectedly
Felt that you were unable to control the important things
Felt nervous and "stressed’
Dealt successfully with irritating work hassles
Felt that you were effectively coping with important changes that were occurring at work
Felt confident about your ability to handle your personal problems while trying to work
Felt that things were going your way
Found that you could not cope with all the things that you had to do
Been able to control irritations
Felt that you were on top of things
Been angered because of things that happened that were outside of your control
Found yourself thinking about things that you have to accomplish
Been able to control the way you spend your time
Felt difficulties were piling up so high that you could not overcome them

Briefly describe how you felt (e.g., physically, mentally) during your work shifts this week. (text entry)

Briefly describe how you felt (e.g., physically, mentally) when you were *not* at work this week. (text entry)