EFFECTS OF AN ONLINE MEDITATION-BASED INTERVENTION COMPARED TO AN ATTENTION-CONTROLLED GROUP ON CHRONIC PAIN OUTCOMES AMONG NURSES: A DOUBLE-BLIND RANDOMIZED CONTROLLED PILOT STUDY

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by
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COMPARED TO AN ATTENTION-CONTROLLED GROUP

ON CHRONIC PAIN OUTCOMES AMONG NURSES:

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CONTROLLED PILOT STUDY

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ABSTRACT

Background

Nurses, central to healthcare, are experiencing chronic pain and stress, which affects their personal and professional lives. Due to multiple roles, they lack time to practice self-care.

Purpose

To evaluate the feasibility and acceptability of conducting an online, asynchronous, three-week, double-blind, randomized-controlled meditation-based intervention compared to an active-controlled group on chronic pain outcomes of stress, serum cortisol, self-compassion, professional caring, pulse rate, and as needed over-the-counter pain medication among nurses.

Method

Three-week, online, asynchronized, double-blind, randomized controlled pilot study with 40 United States nurses.

Results

Analysis of covariance and ordinal logistic regression indicated that the intervention did not have an effect on the outcomes collected. However, unsolicited self-reports indicated improvements in symptoms.

Conclusion

This study indicates improved outcomes per self-reports and invites further research into micro-practices as a possible effective strategy for managing chronic pain and stress among nurses.

APPROVAL PAGE

The faculty listed below, appointed by the Dean of the School of Nursing and Health Studies, has examined a dissertation titled "Effects of an Online Meditation-Based Intervention Compared to an Attention-Controlled Group on Chronic Pain Outcome among Nurses: A Randomized Controlled Pilot Study," presented by Jyoti Valluri, candidate for the Doctor of Philosophy degree, and certify that, in their opinion, it is worthy of acceptance.

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CHAPTER 1

INTRODUCTION TO CHRONIC PAIN

Chronic pain (CP) and stress have heightened in the nursing population due to the Coronavirus 2019 (COVID-19) pandemic, and the variants are still impacting healthcare in 2022 (LeClaire et al., 2022; Taylor-Clark et al., 2022). Nurses have faced an unprecedented toll on their health during COVID-19, yet they have continued to care for their patients, families, and colleagues (Sitzman & Craven, 2021). However, these new factors impacting nurses' health sit on top of the pre-existing chronic pain that nurses experience. Although there are no studies on nurses' generalized chronic pain, chronic low back pain among nurses was discovered to affect their ability to provide quality care (Budhrani-Shani et al., 2016). During the literature search, a story by Nurse Anne Fuqua in the *Kansas City Star* about her chronic pain highlighted the primary reason for this research. As a 38-year-old hospice nurse, she could not find adequate medications to manage her chronic pain. "I would love to return to working as a nurse, though I can't imagine doing it now" (Fuqua, 2018, para. 7). Based upon experiences and the literature, her experience triggered my quest for further evidence-based knowledge and practices to help nurses with CP.

Consequently, a pilot study was completed to gather the impact of chronic pain on nurses' professional and personal lives (Valluri et al., n.d.). Of a sample of 423 nurses from five countries, 293 completed the survey. Of the participants who completed the study, 81.8% noted that they experienced CP frequently, which profoundly impacted their lives (86.3%) and their professional duties (69.2%). In comparison, 87% stated they were receptive to learning about meditation as an intervention to help them manage their pain

(Valluri et al., n.d.). One nurse said, “it [CP] has made my world very small.” This study is dedicated to bringing evidence-based interventions to help nurses manage their CP with free meditation-based interventions to impact CP in nurses, which in turn can improve the ability of nurses to care for patients.

Background of the Problem

Nurses’ greatest gift to patients is their healing presence (Watson & Woodward, 2006). However, when nurses experience high professional stress and pain lasting more than three months, they cannot provide competent patient care (Budhrani-Shani et al., 2016; Kemper et al., 2011; Martinez-Calderon et al., 2019). Pain that lasts more than three months has been defined as chronic pain (CP) (Martinez-Calderon et al., 2019). The Centers for Disease Control and Prevention (CDC) estimates that approximately 20.4% of adults suffer from CP (Waters & Graf, 2018). The costs of CP are $1.1 trillion in lost wages, productivity, and medical expenses for all sufferers. Chronic pain is more prevalent than diabetes, heart disease, and cancer (Dahlhamer et al., 2018; Deer et al., 2014; Fine, 2011). Although the original cause of CP is varied, the experience, intensity, duration, and impact of CP depend on the psychological and emotional statuses, health literacy levels, and health-related behaviors of the individuals (Carson et al., 2005; Dahlhamer et al., 2018; Hilton et al., 2017; Institute of Medicine, 2011; Pagán-Ortiz et al., 2021; Sullivan et al., 2006; Veehof et al., 2016). Chronic pain is often managed by medication, but medication intake often depends on the cost of healthcare, access, sex, gender, ethnicity, culture, and previous experiences with healthcare providers (Fillingim, 2009; Fillingim et al., 2019; LeResche et al., 2015; Richardson & Holdcroft, 2009; Robinson et al., 2001; Werner & Malterud, 2003). If CP is

not treated, it becomes more complex, creating structural changes in the brain's nervous system, evolving beyond the original cause, and becoming a different condition of its own (Fine, 2011; Hannibal & Bishop, 2014; Mutso et al., 2012; Zeidan et al., 2012). This study evaluated the effectiveness of a three-week, online, asynchronous, meditation-based micro-practices intervention compared to an active control group on the CP levels of participants. The literature reviewed showed that brief periods of mindfulness-based practices can affect a person's pain responses and improve their mental well-being (Hilton et al., 2015; Lam et al., 2015; van Agteren et al., 2021; Zeidan et al., 2011).

It is interesting to note that the physiological changes seen in the brain due to CP have been demonstrated to cause interruptions in social, professional, and personal engagements and lead to anxiety, depression, use of opioids, high cost of healthcare, and a reduction in quality of life (Chiesa & Serretti, 2010; Dahlhamer et al., 2018; Institute of Medicine, 2011; Marso, 2018). These interruptions in daily life cause social isolation, which increases the severity and length of CP individuals experience (Fine, 2011; Smith et al., 2001). Individuals with CP work to maintain an interventional approach to their pain, and abrupt medication disruptions cause chaos for the CP sufferer. It is known that during the Coronavirus 2019 (COVID-19) pandemic, pain clinics were closed or restricted, emergency departments were at capacity, and many elective procedures to manage CP were on hold (Eccleston et al., 2020). Although most people have access to telemedicine to manage pain, some must do without access to technology and, therefore, without access to treatment (Eccleston et al., 2020). As CP increases, it also increases chronic stress, leading to heightened pain and impacting social interactions and professional environments (Abdallah & Geha, 2017;

Dueñas et al., 2016). For nurses, this may lead to decreased ability to provide competent or caring patient care (Abdallah & Geha, 2017; Budhrani-Shani et al., 2016; Davis & Kotowski, 2015; Kemper et al., 2011; Villemure & Bushnell, 2002; Vuori et al., 2014).

Definition of Terms

Although the terms used in this study are common, such as meditation or pain, they may have personal meaning to readers. Therefore, the following list provides definitions for commonly used terms to bring clarity and consistency to the information throughout the study (Creswell & Creswell, 2018).

Active control group (ACG) is defined as the group randomized into the control group whose attention was captured through links to self-improvement TED talks, readings, and research articles on relevant topics.

Chronic pain is defined as pain lasting over three months that interferes with daily activities (Martinez-Calderon et al., 2019).

Cortisol is a steroid hormone manufactured from cholesterol by the adrenal cortex (Thau et al., 2019).

Compassionate micro-practices are defined as mindful actions for self, family, and society that facilitate genuine caring and do not require more time or stress to practice self-care (Hanh, 2008; Sitzman & Craven, 2021).

INDIRA is an acronym generated using the website acronymify.com. It stands for "A Three-Week Online Randomized Controlled Trial to Determine the Impact of Meditation-based Intervention Compared to an Attention Controlled Group, on Nurses' Chronic Pain

Outcomes of Pain, Stress, Self-compassion, Professional Caring, Pulse Rate, Medication Intake, and Cortisol."

Loving Kindness Meditation is defined as making one's breath slower, calmer, and deeper while relaxing the body and creating feelings of unconditional love and kindness towards oneself and others (Shonin et al., 2015; Weil, 2016; Zeng et al., 2015).

The Loving Kindness Meditation group (LKM) is defined as the group randomized into the intervention group.

Medication intake is defined as the extent to which the patient's self-report of taking analgesic medication is congruent with the healthcare provider's recommendations (Russell et al., 2006; Sabate, 2003).

Meditation is defined as any practice that allows a person to connect one's mind with the deeper Self (Sharma, 2015; Stanford, 2013; Taylor, 2013).

Mindfulness-based intervention (MBI) are studies with meditations as the primary intervention (Baer, 2014). For this study, the MBI consisted of the practice of Loving Kindness Meditation and compassionate micro-practices throughout the day (Shonin et al., 2015; Sitzman & Craven, 2021; Watson, 2018).

Neuroplasticity is the brain's ability to adapt, remodel, and reorganize under repeated stimuli due to practice or conditions (Bijoch et al., 2020; Konorski, 1948).

Nurse is defined as a person licensed by the state board of nursing that is currently providing or has provided direct patient care, education, research, or administration in the field of nursing (Alligood, 2017).

Pain uncoupling is defined as cognitive mechanisms that help downregulate the sensory experience of pain from an imminent anticipated threat to a passing wave of physical sensation, which results in lowered pain catastrophizing (Zorn et al., 2020).

Professional caring is defined as intentionally providing "technical, emotional, mental, aesthetic, humanistic, ethical and technically" complex care and progress in self-development (Watson, 2011, p. 78).

Pulse rate is defined as the pressure wave transmitted through the arteries due to each heart contraction (Marieb & Hoehn, 2007).

Self-compassion is defined as accepting one's suffering with compassion, developing an attitude of understanding towards one's perceived inadequacies, and recognizing one's experience as being a part of a more extensive life experience (Neff, 2003).

Stress is defined as any stimuli that become overpowering and unpredictable, impacting one's ability to perform personal and professional tasks (Cohen et al., 1983).

Significance of the Problem

According to the U.S. Bureau of Labor Statistics, there are 2,215,929 registered nurses currently working. They make up the largest workforce among healthcare workers and comprise the fifth largest occupation in the U.S. (U.S. Bureau of Labor Statistics, 2022). In the pandemic caused by COVID-19, the workload for nurses has increased, patients admitted to the hospital have higher acuity and mortality, and family members may be infected with COVID-19. The nurse may experience increased physical exhaustion (Ehrlich et al., 2020). There is a higher-than-usual chance of musculoskeletal injuries during critical emergencies due to strains, tears, and sprains (Dressner & Kissinger, 2018). Before the pandemic,

registered nurses' injury rate was 46.0 cases per 10,000 full-time equivalent employees, which is twice as high as that of all other occupations (Dressner & Kissinger, 2018). According to the U.S. Bureau of Labor Statistics (BLS), during the COVID-19 pandemic (2019), the injury rate for registered nurses was 78,740 total cases, which involved 11,530 pains, tears, or sprains and 1,620 fractures among other work-related injuries that required days away from work (U.S. Bureau of Labor Statistics, 2022). Prior to the pandemic, 12% of nurses were leaving the profession annually due to CP, and another 12% declared intent to leave the profession due to CP (Nelson & Baptiste, 2006), causing a potentially high turnover rate (Fochsen et al., 2006; Samaei et al., 2017). During the COVID-19 pandemic, it was found that nurses' intent to leave their current job varied among countries. In Germany, the rate was 18% (Schug et al., 2022); in the United Kingdom, the intent to leave the current job was 37.8%, and the plan to leave healthcare was 28.6% (Couper et al., 2022). In the United States, the intent to leave the current job in the next two years ranged from 40% to 49% (LeClaire et al., 2022; Taylor-Clark et al., 2022).

Even before COVID-19, nurses did not have the training and coping skills to deal with CP, professional stress, and personal stress and reported developing distress, hypertension, apathy, substance abuse, and suicidal thoughts (Alderson et al., 2015; Batalla et al., 2019; Hooley et al., 2014; Jordan et al., 2016). These stressors in nurses lead to nursing burnout, which contributes to a high turnover rate (Fochsen et al., 2006; Samaei et al., 2017). When one full-time nurse leaves the profession, the tangible cost of replacement for an average American hospital ranges from $36,567 to $40,038, while a 1% gain in retention results in savings of $306,400 annually (Colosi, 2021; Kress et al., 2015; Robert Wood

Johnson Foundation, 2009). However, the intangible costs of nurses' loss of control, self-esteem, hopelessness, dissatisfaction, burnout, and suicidal thoughts are immeasurable (Alderson et al., 2015; Budhrani-Shani et al., 2016; Dueñas et al., 2016; Hooley et al., 2014; Karhula et al., 2016; Sleed et al., 2005). With the current status of change and intent to leave the profession, nursing can not sustain the current loss of practicing nurses, nor can it sustain the current personal impact of nurses who experience CP (Bazarko et al., 2013; Budhrani-Shani et al., 2016; Haddad et al., 2020).

A recent literature review demonstrates that meditation can help manage CP for all practicing individuals (Carson et al., 2005: Galante et al., 2014; Wilson & Cramp, 2018). Additionally, the literature demonstrates that meditation is an ancient and longstanding practice, going back to ancient Egypt, India, and Burma regions of the British Raj (Ashby, 1997; Aurelius, 2003; Loizzo, 2016; Sharma, 2015). Within the literature, it is noted that several forms of meditation have been studied for many physiological and psychological benefits. These studies have found that meditation can help align with one's well-being (Szekeres & Wertheim, 2015; Trindade et al., 2020; Wachholtz et al., 2017). Recently, the four-year longitudinal study by Jon Kabat-Zinn using Mindfulness-based Stress Reduction (MBSR) for CP influenced the integration of the term "mindfulness" into Western clinical practice (Baer, 2014; Williams et al., 2015). The definition of mindfulness, according to Kabat-Zinn, is "paying attention in a particular way: on purpose, in the present moment, nonjudgmentally" (Zinn, 1994, p. 4).

In Western literature, mindfulness is associated with cultivating focused attention (Hölzel et al., 2011; Lutz et al., 2015). However, Buddhist and Tibetan language scholars

argue that the word mindfulness, translated from the word *sati* found in sacred Sanskrit texts (Pali Abhidhamma), "alters the true meaning and function of the practice of meditation" (Purser, 2015, p. 23). The Buddha's instructions for meditation practices were to include both Samatha (tranquility meditation) and vipassana (insight meditation) on retrospective (remembering the past) and perspective (remembering to do things differently in the future) (Wallace, 2008). Tibetan Buddhist teachings say that meditative practices allow us to develop a skill where we are fully and lovingly aware of our thoughts about the past, but we dare to take different actions full of wisdom and compassion (Stanford, 2013; Wallace, 2008).

In another set of teachings about meditation from the Vedic tradition, the main goal of a formal and informal meditative practice is to form a deeper connection of the conscious mind with the deeper Self (Sharma, 2015). Many meditation practices, including the widely researched MBSR, have a strict protocol of initiation, training, and practice and often involve a fee ranging from thousands of dollars (Avvenuti et al., 2020; Lang et al., 2019; Williams et al., 2015). This leads one to consider alternative, cost-effective approaches. One such meditation approach is Loving Kindness Meditation, which fosters the desire to develop and deepen loving kindness for self and others (Hahn, 2015; Stanford, 2013; Taylor, 2012). This practice focuses on creating self-compassion, which is critical, as it promotes health-seeking behaviors to alleviate the suffering caused by CP (Carson et al., 2005). Loving Kindness Meditation leads one to understand the impact of reflections—they are considered to be a protective factor against adverse health outcomes such as chronic pain, and compassionate actions prolong the effects of such meditation (Altman et al., 2020; Atanes et al., 2015;

Carvalho et al., 2018; McCracken et al., 2004; Zhang et al., 2020). The practice of Loving Kindness Meditation has been studied empirically for CP and other ailments according to systematic and meta-analysis (Carson et al., 2005; Galante et al., 2014; Hilton et al., 2017; Hofmann et al., 2015; Kim et al., 2019; Shonin et al., 2015). The practice of mindfulness meditation is associated with changes in activity and structure of brain areas thought to be involved with compassion, love, and caregiving behavior (Boellinghaus et al., 2014; Cahn & Polich, 2006; Lazar et al., 2000; Tirch, 2010). Similar to the Buddhist teachings, the theory of Positive Psychology teaches that our lives are constantly changing, and unwanted things occur (Seligman, 1998; Seligman & Csikszentmialyi, 2000). However, by acknowledging the present moment without catastrophizing the events, focusing on the positive aspects, and taking self-care actions, one can experience inner happiness and well-being despite the present circumstances (Compton & Hoffman, 2020; Seligman, 2019). Based on Tibetan Buddhist teachings and Positive Psychology theory during the INDIRA study, the nurses listened to a guided meditation by Dr. Jean Watson (2008). The goal of Watson's Caring Science theory is congruent with the practice of Loving Kindness Meditation, Positive Psychology theory, and Self Compassion theory, as these combined theories encourage nurses to focus on compassionate self-care actions that can improve cognitive thinking, behavioral responses, and subjective experiences of pain (Schaffer & Curtin, 2020; Watson & Foster, 2003). Additionally, Dr. Jean Watson encourages the development of meditative practices and loving kindness towards self and others to find meaning in suffering, pain, and illness, and gain control, self-knowledge, and self-healing to restore a sense of inner harmony "regardless of the external circumstances" (Watson, 1999, p. 54).

As meditation becomes integrated into more and more lives, scientists are using functional Magnetic Resonance Imaging (fMRI) to understand better the physiological impact of meditation practices. These studies with the fMRI examine how the brain changes within just a few days of meditation practices and significantly improves all quality-of-life outcomes for CP patients (Apkarian et al., 2005; Awasthi, 2013; Gard et al., 2012; Reich et al., 2014; Tang et al., 2015; van Agteren et al., 2021; Zeidan et al., 2011). Similar studies, systematic reviews, and meta-analyses on CP also conclude that meditation interventions reduce CP effects such as stress and musculoskeletal pain, and increase quality of life, self-compassion, biomarkers, and fMRIs for both nurses and their patients (Bernal et al., 2015; Bonzini et al., 2015; Lazar et al., 2005; Lomas et al., 2015; Martinez-Calderon et al., 2019). The interventions based on meditation studies are collectively called mindfulness-based interventions (MBIs) (Baer, 2014; Hilton et al., 2017; Martinez-Calderon et al., 2019). Although controversial in the root tradition of Buddhism and other religious traditions practicing meditation, the term mindfulness, especially mindfulness as taught in Kabat-Zinn's Meditation-Based Stress Reduction, is widely used by medical and psychological researchers (Baer, 2014; Crane et al., 2017; Purser, 2015; Williams et al., 2015).

Additionally, other research studies have shown that formal meditation practice can impact health and well-being even after just five minutes of participating in the course, and cortisol levels drop with five, 10, and 15 minutes of practice (Bansal et al., 2016; Barker et al., 2005; Bottaccioli et al., 20140; Heckenberg et al., 2018; Lam et al., 2015; Singh & Modi, 2012). In a systematic analysis of meditation-based interventions (MBI) to reduce workplace stress, Heckenberg et al. (2018) analyzed 10 RCTs (Random Controlled Trials) with (n =

812). They determined that MBI effectively reduced workplace physiological stress, reduced overall cortisol production, and improved productivity. The reduction in cortisol and other physiological benefits were found in long-term and, surprisingly, in short-term interventions (Bansal et al., 2016; Barker et al., 2005; Lam et al., 2015; Tang et al., 2010; Zeidan et al., 2010).

The above studies demonstrate that the reduction of meditation training time from the traditional 15 to 20 minutes to three to seven minutes of practice has been discovered to minimize the effect on physical or psychological outcomes consistent with long-term practitioners (Coster et al., 2020; Galante et al., 2014; Lam et al., 2015; Tang et al., 2010; Zeidan et al., 2010). Brief 3-day, 20-minute MBIs were found to be effective in lowering heart rate, blood pressure, and pain measurements, and these outcomes were consistent with those of long-term practitioners (Zeidan et al., 2010). In a systematic analysis of 22 research studies, Loving Kindness Meditation of five to 15 minutes of practice over two to four weeks effectively reduced suffering and increased participants' well-being (Galante et al., 2014). A 15-minute, three-week intervention for people with a limited amount of money and time was also found to be effective in helping 42 healthy individuals develop mood and emotional regulation, which is responsible for decreased cortisol production in response to daily stressors (Wu et al., 2019). One-day mindfulness-based interventions (MBIs) had low attrition rates among healthcare workers, but higher attrition rates were reported for MBIs that lasted longer than eight weeks (Galante et al., 2014; Seppala et al., 2014). Additionally, mindful, compassionate actions throughout the day prolonged and deepened the effects of peace experienced during meditation practices (Kabat-Zinn et al., 2011; Sharma, 2015;

Stanford, 2013). Recently, compassionate actions have been termed micro-practices (Griffin et al., 2021; Sitzman & Craven, 2021) and were incorporated into this study along with MBI. The meditation-based intervention had two components: a formal practice of meditation and informal micro-practices for three weeks (Carson et al., 2005; Griffin et al., 2021; Sitzman & Craven, 2021). It was hypothesized that via this randomized controlled trial, nurses who spend a few minutes in meditation and practicing consistent self-caring actions throughout the day would be able to manage their pain better and hence be able to bring their authentic caring presence to work (Compton & Hoffman, 2020; Larsen, 2014; Sitzman & Watson, 2018). Additionally, it could be inferred that by improved management of pain and increased authentic caring presence of the nurse at work, there may be less likelihood of the nurse leaving the profession due to the inability to manage their CP (Bernal et al., 2015; Moreira et al., 2014).

Importance of the Study

Although there are several quantitative research studies on meditation and CP, the only published study currently found in the literature regarding the effectiveness of MBIs for nurses' chronic pain was conducted by Lopes et al. (2019). In their cross-sectional study with 64 nursing professionals in San Paolo, Brazil, a 6-week adapted MBSR was effective in reducing depression, anxiety, pain catastrophizing, and musculoskeletal pain ($p < .001$) and increasing self-compassion and quality of life scores ($p < 04$) (Lopes et al., 2019). However, the study did not collect information on the ability to provide patient care and did not have a control group (Lopes et al., 2019). Recently nurses' stress has been increased due to the COVID-19 pandemic, leading to burnout and a lack of compassion and caring (Eccleston et

al., 2020; LeClaire et al., 2022; Sitzman & Craven, 2021; Taylor-Clark et al., 2022). Even pre-pandemic pain was directly correlated to concerns about the quality of life, stress, burnout, interpersonal relationships, and personal recovery (Dyrbye et al., 2019; Roy, 2006; van Agteren et al., 2021). With the management of CP, there is potential to have healthier nurses who can fulfill the core tenet of nursing practice and provide their real caring healing presence to the patients (Pajnkihar et al., 2017; Sitzman & Craven, 2021; Watson, 2018). Thus, the proximal goal of this pilot study was to test the feasibility and acceptability of administering the larger, more extensive INDIRA study to reduce the impact of CP on nurses' lives currently, with the distal goals of improving personal caring, professional satisfaction, and improved patient care.

Research Design

The research design of this study was to test the feasibility of conducting a randomized controlled trial (RCT), which had the potential to yield the highest level of evidence (Level I), addressing the impact of MBI compared to the active control group on CP outcomes in nurses (Polit & Beck, 2020). This study's aim was to confirm that the electronic delivery of the content was acceptable and feasible for the participants with the help of resources at the University of Missouri-Kansas City (see Appendix A). The sampling method for this study was conducted through social media and professional contacts (Jones, 2017). Nurses were asked to share the link, meeting the internet snowball convenience sampling requirements (Kosinski et al., 2015).

The effectiveness of this intervention was assessed via four instruments and three physical pain markers (Munro, 2005). The CP outcomes assessed were pain, stress, cortisol,

pulse rate, self-compassion, and professional caring. The effectiveness of MBI on these outcomes were collected through the use of the following tools: Numeric Pain Scale Rating (NPSR; Cleeland & Ryan, 1994; Dworkin et al., 2005); Perceived Stress Scale (Cohen et al., 1983); Caring Factor Survey–Care Provider Version (Nelson et al., 2011); Self-Compassion Scale–Short Form (Neff, 2003); serum cortisol levels (Matousek et al., 2010); pulse rate (Cowen et al., 2015); and the need for over-the-counter pain medication intake (Cowen et al., 2015).

Research Questions

The following are the research questions (RQ) and proposed null hypotheses (H_0) and alternative hypotheses (H_1) for each question.

RQ 1. What is the feasibility of nurses with chronic pain participating in a three-week online intervention compared to a Positive Psychology education attention-control intervention?

RQ1a) To what extent can we successfully recruit required sample nurses via social media and email?

RQ1 b) What is the attrition rate?

RQ1 c) To what extent can the intervention procedures be implemented as planned?

RQ1 d) To what extent do participants maintain adequate fidelity to the procedures?

RQ1 e) To what extent are the measures completed and submitted on time?

RQ1 f) To what extent is it cost-effective to use LetsGetChecked for cortisol serum testing?

RQ 2. What is the acceptability of the study of using online asynchronized intervention for nurses' chronic pain outcomes?

RQ2 a) To what extent do the nurses accept driving to LetsGetChecked for testing?

RQ2 b) To what extent do the nurses accept their assignment in the control group?

Inferential statistics were conducted using analysis of covariance (ANCOVA) with pre-study pain levels (pre-NPS as a covariate) for the following questions (Munro, 2005):

RQ 3.1 To what extent and in what ways does the LKM influence self-reported CP at the end of an intervention after controlling for variability in initial self-reported CP?

($H1_0$) There will be no change in the mean value of the dependent variable of self-reported CP in the LKM group compared to the ACG group.

($H1_1$) The mean value of the dependent variable of self-reported CP will be lower in the LKM group compared to the ACG group.

RQ 3.2 To what extent and in what ways does the LKM influence stress at the end of an intervention after controlling for variability in initial self-reported CP?

($H2_0$) is that there will be no change in the mean value of the dependent variable of stress in the LKM group compared to the ACG group.

($H2_1$) is that there will be a change in the mean value of the dependent variable of stress will be lower in the LKM group compared to the ACG group.

RQ 3.3 To what extent and in what ways does the LKM influence self-compassion at the end of an intervention, after controlling for variability in initial self-reported CP?

($H3_0$): There will be no change in the mean value of the dependent variable of self-compassion in the LKM group compared to the ACG group.

($H3_1$) is that a change in the mean value of the dependent variable of self-compassion will be higher in the LKM group compared to the ACG group.

RQ 3.4 To what extent and in what ways does the LKM influence self-reported professional caring at the end of an intervention after controlling for variability in initial self-reported CP?

($H4_0$) is that there will be no change in the mean value of the dependent variable of professional caring in the LKM group compared to the ACG group.

($H4_1$) is that there will be a change in the mean value of the dependent variable of professional caring will be higher in the LKM group than in the ACG group.

RQ3.5 To what extent and in what ways does the LKM influence serum cortisol at the end of intervention after controlling for variability in initial self-reported CP?

($H5_0$) is there will be no change in the mean value of the dependent variable of serum cortisol among nurses in the LKM group compared to the ACG group.

($H5_1$) is that a change in the mean value of the dependent variable of serum cortisol will be lower in the LKM group compared to the ACG group.

Ordinal logistic regression was conducted to analyze the relationship between ordinal dependent variables (pulse and PRN medication) and two predictor variables of intervention and pre-NPS (Navarro & Foxcroft, 2018).

RQ3.6 To what extent and in what ways does the LKM influence self-reported pulse rate at the end of intervention after controlling for variability in initial self-reported CP?

($H6_0$) is that there will be no change in the mean value dependent variable of pulse rate in the LKM group compared to ACG.

($H6_1$) is that there will be a change in the mean value-dependent variable of self-compassion will be higher in the LKM group compared to the ACG group.

RQ3. 7 To what extent and in what ways does the LKM influence pain medication intake at the end of an intervention, after controlling for variability in initial self-reported CP?

($H7_0$) is that there will be no change in the mean value of the dependent variable of the average prescription medication intake in the LKM group compared to the ACG group.

($H7_1$) is that there will be a change in the mean value of the dependent variable of the average prescription pain medication intake will be lower in the LKM group compared to the ACG group.

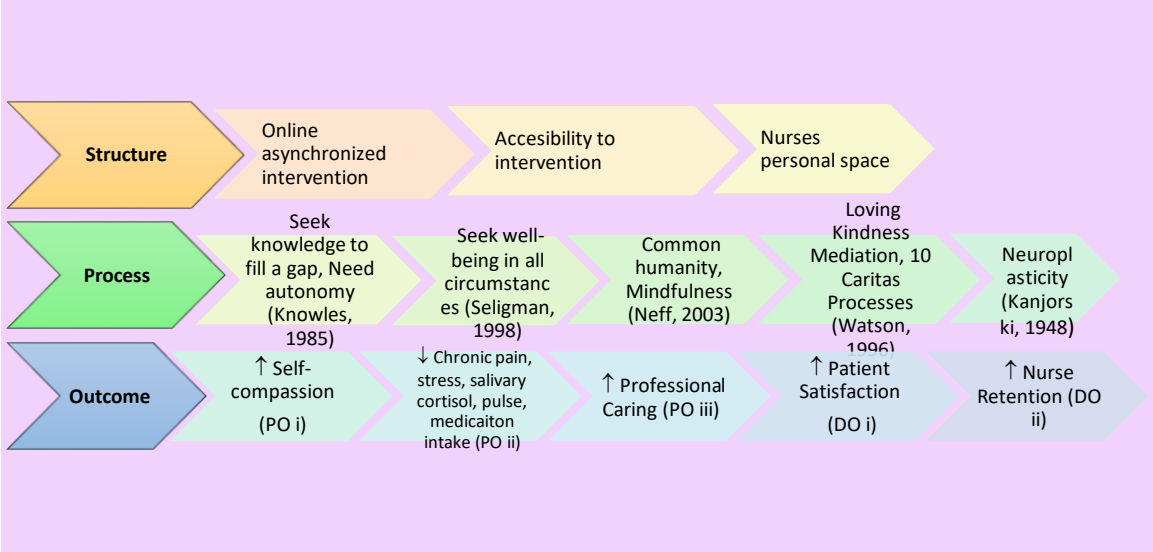
Theoretical Support

The theoretical framework that supports this study is based on Donabedian's Structure-Process-Outcome Quality Care Model (Donabedian, 1966). According to Donabedian, it is essential to evaluate quality care on three levels: (a) Who or what is being assessed? (b) What are the activities being conducted? (c) How are these activities being assessed? For these three levels, Donabedian proposed the use of (a) structure, which denotes attributes of the setting where the care is being provided, (b) process, which denotes describing what is being done; (c) outcomes, which denote the effects of the care being provided (Donabedian, 1988, 2005). A strong structure increases the effectiveness of an exemplary process which can be measured in good outcomes (Donabedian, 1988, 1996). One must know the working relationship between all these elements before the quality care

evaluation can be undertaken (Donabedian, 1988). A thorough understanding of the working relationship between structure, process, and outcome is presented in this document, with a visual diagram presented (see Figure 1.1).

Figure 1.1

Donabedian's Theory



The INDIRA study is an acronym generated by acronymify.com for a three-week online randomized controlled pilot trial to determine the impact of the meditation-based micro-practices intervention, compared to an attention-controlled group, on nurses' chronic pain outcomes of pain, stress, self-compassion, professional caring, pulse rate, medication intake, and cortisol. The web-based MBI allows the participants to practice at home, work, or at the organization where the participants provide care. The construct of the process is defined as activities done to improve the intervention's usability based on the theories of Positive Psychology and Adult Education. The improvement in self-care and patient care is

based on theories of Self-compassion (Neff, 2003) and Caring Science (Watson, 2011). Outcome refers to the consequences of the process (Donabedian, 1966). The improvement in CP outcomes is based on neuroplasticity theory (Konorski, 1948).

The main concepts of the five theories are as follows. Positive Psychology states that humans can thrive in any condition by nourishing their best positive aspects (Seligman, 1998). The theory of Adult Education says that adult students are self-directed, have rich experiences, seek information to fill a need, and need immediately usable information (Knowles, 1973). The theory of Self-compassion is based on kindness, common humanity, and mindfulness (Neff, 2003). The theory of constructs of Caring Science is intentionality, the transpersonal-caring relationship, and human dignity, which can be implemented into daily practice through the ten Caritas Processes/loving, caring actions (Watson, 1996). By providing self-care, the nurse can create a holographic transpersonal-caring effect between patients, families, organizations, and the nurse (Sitzman & Watson, 2018). These theories provide interlocking support for this study. The regular practice of MBI leads to neuroplasticity influenced by neurogenesis caused by repeating the MBI skills (DeMarin & Morovic, 2014).

Conclusion

When nurses are in CP, they cannot bring their full caring presence to facilitate healing for themselves or their patients. Chronic pain has been shown to impact the profession of nursing negatively. Using an MBI, such as Loving Kindness Meditation, provides nurses with tools to respond to the stimulus of personal pain with self-compassion as they choose. This can be accomplished through formal or informal practices that may

prolong the impact of meditation, prevent pain catastrophizing, and have a protective effect against pain. This chapter presented a brief overview of the study, historical perspective, and theoretical frameworks. Based on the present literature, this study aimed to address a gap in the literature addressing CP in nurses and the impact of CP management via MBI. Using feasibility protocols presents the best opportunity to generate data that the study is efficacious, acceptable, and of interest to the participants. Moreover, feasibility studies provide data on how to shape future RCT, thus avoiding expensive mistakes. Additionally, further study and data analysis may demonstrate to hospitals and healthcare systems that investing a small percentage of the $2 billion spent on costs of absenteeism, lost productivity, patient falls, and medication errors are not only proactive but could have the potential to improve nurse retention, job satisfaction, and patient outcomes.

CHAPTER 2

REVIEW OF LITERATURE

Chronic Pain

This chapter presents literature support for each element of the INDIRA study. Operational definitions for commonly used terms are provided to familiarize the readers with the terms. The foundations of the study are created by giving the background for chronic pain and the costs of incidence, prevalence, and consequences of unmanaged chronic pain among nurses (Ratanasiripong et al., 2015). Subsequently, the rationale for meditation interventions based on evidence are presented in an organized fashion. The interventions discussed have been noted to have an impact on chronic pain, stress, pulse rate, medication intake, and serum cortisol levels, as well as an increase in self-compassion and professional caring (Chang et al., 2016; Gauthier et al., 2015; Spadaro & Hunker, 2016; Tsai & Crockett, 1993).

The historical perspective of meditation is presented to demonstrate the linkage between this and the current use of meditation in the western medical research community, as noted by Kabat-Zinn's longitudinal study on chronic pain (1985), which informs contemporary researchers (Liozzo, 2014; Perepelkin et al., 2019; Zeidan et al., 2012). Background on Loving Kindness Meditation (LKM) and Positive Psychology are presented, as these were the interventions used in this study.

Furthermore, the existing gap in the literature on nurses' chronic pain are presented. The potential impact of this study on nurses experiencing CP and nursing practice are explored with a proximal goal of determining the effects of meditation on chronic pain in

nurses and their ability to provide quality patient care, which may impact patient satisfaction scores and even help with the retention of nurses in the practice setting.

Incidence

According to the International Association for the Study of Pain (IASP), chronic pain is defined as recurrent or persistent cancerous or noncancerous pain that lasts longer than three months or longer than normal healing time of acute injury and that interferes with daily activities (Barke et al., 2022; Martinez-Calderon et al., 2019; Raffaeli et al., 2021; Scheer et al., 2009; Treede et al., 2015). In a 10-year review from 2000 to 2010, 20.7% of doctor's office visits (1,616 million out of 7,802 million) were for the treatment of chronic pain (Daubresse et al., 2013). The Centers for Disease Control and Prevention (CDC) estimates that approximately 20.4% of adults (50.0 million) suffer from chronic pain, costing $1.1 trillion annually (Dahlhamer et al., 2018; Waters & Graf, 2018). Chronic pain in the U.S. population has a higher incidence than diabetes, heart disease, and cancer combined (Deer et al., 2014). Chronic pain is the most underestimated and underreported disease and has a physical, psychological, emotional, and financial impact on those affected (Latina, 2013). Chronic pain outcomes affect not just the individual but also professions like nursing and society as a whole due to high costs related to healthcare services, disability compensations, loss of productivity, and lost wages (Dahlhamer et al., 2018; Fine, 2011). These data include nurses who care for patients in ways that go beyond that medical tasks (Watson, 2008). Nurses help problem-solve, teach, clarify, and comfort patients (Watson, 2006, 2007, 2008, 2011). It has been stated that nurses' most valuable gift to patients is their healing presence (Watson & Woodward, 2006). However, when nurses experience high professional stress and

chronic pain, they cannot communicate fully nor provide competent patient care (Budhrani-Shani et al., 2016; Kemper et al., 2011). Additionally, during the current Coronavirus pandemic, chronic pain patients experienced severe pain management disruptions, increasing their anxiety and stress levels (Eccleston et al., 2020). This includes nurses who could not access care to assist with their CP needs due to abrupt disruptions of these services due to the pandemic shutdown (Eccleston et al., 2020). During increased patient acuity, nurses' injury rates increase, impacting their stress and pain levels (Kheiry et al., 2019; Nelson & Baptiste, 2006; Tuna et al., 2022).

Prevalence Among Nurses

Nurses make up the fifth largest workforce in the world, and there are 28 million nurses globally (WHO, 2017). According to the U.S. Bureau of Labor Statistics (2019), as of May 2019, 3,080,100 registered nurses were working in the United States. Prior to the pandemic, the rate of injury for nurses was 46.0 cases per 10,000 in full-time hours (U.S. Bureau of Labor Statistics, 2019). During the pandemic in 2019, it was 166.3 cases per 10,000 full-time working hours (U.S. Bureau of Labor Statistics, 2019), which represents an increase of 260.9%. During the COVID pandemic, nurses experienced high patient acuity, high patient census, and an increased workload, which contributed to high stress levels, an increase in the number of physical injuries, and disruptions to regular pain management treatment for chronic pain (Eccleston et al., 2020; Janssen & van der Voort, 2020; Specht et al., 2021; Yifan et al., 2020). The injury rate for registered nurses was 78,740 total cases, involving 11,530 identified injuries such as pains, tears, or sprains and 1,620 fractures, among other work-related injuries that required days away from work (U.S. Bureau of Labor

Statistics, 2022). Prior to the pandemic, 12% of nurses were leaving the profession due to CP, and another 12% declared intent to leave the profession due to CP (Nelson & Baptiste, 2006), causing a potential high turnover rate (Fochsen et al., 2006; Samaei et al., 2017). Due to the increased stress of COVID, nurses' intent to leave their current jobs varied between countries. In Germany the rate was 18% (Schug et al., 2022); in the United Kingdom, the intention to leave the current job was 37.8%; the plan to leave healthcare was 28.6% (Couper et al., 2022); and in United States, the intention to leave the current job in the next two years ranged from 40% to 49% (LeClaire et al., 2022; Taylor-Clark et al., 2022). Nurses do not receive training in coping skills to deal with professional or personal stress; thus they can develop distress, hypertension, apathy, and substance abuse, which leads to burnout and high turnover rates (Alderson et al., 2015; Batalla et al., 2019; Fochsen et al., 2006; Hooley et al., 2014; Jordan et al., 2016; Samaei et al., 2017).

A comprehensive search of the Academic Search Complete, Psych Info, Complementary Medicine Index, ScienceDirect, PubMed, and Alt HealthWatch databases yielded no results when searching for studies on nurses' chronic pain. Since that search, a single study has been published that evaluated the effectiveness of MBIs for nurses with chronic pain (Lopes et al. 2019). In an attempt to determine if there was a problem of chronic pain in nurses and to gain further understanding of current levels, an exploratory pilot study was conducted by this researcher. This study had 423 participants and investigated how CP affected nurses' professional and personal lives through multiple-choice and six optional questions requiring text responses (Valluri et al., n.d.). Preliminary statistical analysis revealed a high frequency of CP [constantly (22.4%), daily (46.6%), 4-6 times a week

(12.8%)] within those who participated in the survey. The intensity median range was 4.39 (scale of 1 to 10). The prevalence of CP was located in the musculoskeletal system (90.1%), abdominal pain (13.7%), psychogenic pain (10.2%), damage or dysfunction of the central nervous system (10.9%), trigeminal pain 3.9%), and post-mastectomy (1.4%). Chronic pain frequency, intensity, and location impacted nurses' professional (69.2%) and personal (86.3%) lives. All participants (100%) requested self-care modalities for pain management at work, citing a lack of time (75.2%), motivation (40.9%), and fear of pain (31.1%) as reasons for not practicing self-care. Similar to the national turnover rate of 37% due to burnout (Haddad et al., 2020), this pilot study indicated that 39% intended to leave the profession, and 6% stated they had already left the profession due to unmanaged chronic pain. Over 69% of the participants (69.2%) reported that CP impacted their professional lives, as they could not perform their nursing duties to the best of their abilities. In comparison, 86.3% said that CP affected them personally, as they had difficulty interacting with family and friends or social gatherings (Valluri et al., n.d.). This pilot study provided an additional understanding of the need for this interventional study.

Intangible Costs

The costs due to chronic pain come in many forms: loss of productivity at work; impact on family and community; increased medical costs; workers' compensation; loss of wages and tax dollars, all of which accumulates a monetary loss in the trillions of dollars (Breen, 2002; Deer et al., 2018). The intangible costs of chronic pain are felt chiefly by families of those who suffer from CP, and it is not easy to quantify in monetary terms (Sleed et al., 2005). The inability to fully participate in one's personal and professional life leads to

hopelessness and depression, which leads to burnout (Ahola & Hakanen, 2014). During COVID, the demands on nurses were unprecedented, with increased patient load, stressful and emotionally challenging situations, biorhythmic disturbances, disruption in social support, exhaustion, and a sense of personal achievement (Hilton et al., 2017; Sasidharan et al., 2021). Pre-COVID nurses reported high levels of stress leading to burnout due to four main factors: management support, organizational demands, unrealistic work assignments, and individual coping (Bakhamis et al., 2019; Nantsupawat et al., 2016). It is known that nurses lack training in handling the stressful nature of nursing and lack time for personal care, leading many nurses to experience pain, hypertension, high cholesterol, obesity, and anger (Jordan et al., 2015; 2016). Nearly 50% of nurses surveyed reported high levels of depression and suboptimal mental and physical well-being, which are the leading cause of burnout (Dyrbye et al., 2017; Melnyk et al., 2018). Work-related stress also leads to high rates of substance abuse among nurses (Batalla et al., 2019; Ivey, 2018). Additionally, the risk of suicide increases fivefold when nurses' work stress is compounded by personal stress, with chronic pain being an added risk factor (Alderson et al., 2008; 2015; Hooley et al., 2014). Such work-related stress and chronic pain increase cortisol levels that further affect job performance, as increased cortisol decreases the ability to retain knowledge, affecting short-term memory and the speed of memory retrieval, both critical for the profession of nursing (Karhula et al., 2016; Kheiry et al., 2019; Matousek et al., 2010; Nelson, 2015; Villafañe et al., 2020; Vuori et al., 2014; Yamamoto et al., 2009). Less than optimum health is linked to contaminated needle sticks, administering the wrong dosage or medication to the

patients, other medical errors, falls, and subpar quality of care that increases the overall cost of healthcare (Bakhamis et al., 2019; Chesak et al., 2015; Melnyk et al., 2018).

Tangible Costs

The tangible cost of chronic pain (CP) is estimated at $1.1 trillion annually, which is a higher incidence than diabetes, heart disease, and cancer combined, and CP has the most underreported physical, psychological, and emotional cost (Dahlhamer et al., 2018; Deer et al., 2014; Samaei et al., 2017; Waters & Graf, 2018). The Centers for Disease Control (CDC) estimated that approximately 20.4% of adults worldwide are affected by CP (Deer et al., 2014). Mathematically, that means that 20.4% of 3.8 million U.S. nurses (775,200) and 20.4% of 28 million global nurses (5,712,000) may suffer from chronic pain. If such a high number of nurses are in chronic pain, they cannot bring their entire caring presence to provide competent and compassionate patient care (Budhrani-Shani et al., 2016; Kemper et al., 2011; Sitzman & Craven, 2021).

A cross-sectional study with a random sample of 1,171 registered nurses was completed in North Carolina who self-reported that mental health and musculoskeletal pain affected their productivity at work, resulting in medication errors, patient falls, and low scores in quality of care, costing the medical health system in North Carolina $1,346 per nurse annually (Letvak et al., 2012). In a survey of 419 nurses with chronic pain in the Midwest employed full-time (62%) and providing direct patient care (78.1%), it was reported that they experienced pain in the musculoskeletal system frequently (90.1%). Nearly half (48.8%) reported that chronic pain affected their caregiving abilities (Valluri et al., n.d.).

Outcomes of chronic pain are high stress levels, leading to loss of compassion, burnout, absenteeism, and medication errors, costing U.S. medical facilities approximately $2 billion annually (Dahlhamer et al., 2018; Dyrbye et al., 2019; Karhula et al., 2016; Rosenberg et al., 2018). In addition, before COVID-19, approximately 20% of nurses left the profession annually due to stress, burnout, and chronic low back pain—exacerbating the existing shortage of nurses (Haddad et al., 2020; Specht et al., 2021; U.S. Bureau of Labor Statistics, 2019). The cost of replacing one full-time nurse, including advertisement, recruitment, interviews, background checks, orientation, and staff training of the new employee, ranges from $36,567 to $40,038 in an average U.S. hospital (Robert Wood Johnson Foundation, 2009). Employers could support well-being and self-care modalities for chronic pain (Pipe et al., 2012; Sitzman & Craven, 2021; Summers et al., 2015; van Agteren et al., 2021).

In summary, the incidence of chronic pain resulted in 20.7% of the visits to the doctor's office and are the most underreported disease that has an emotional, physical, psychological, and financial impact (Dahlhamer et al., 2018; Daubresse et al., 2013; Latina, 2013; Samaei et al., 2017; Sleed et al., 2005; Waters & Graf, 2018). Approximately 20% of adults worldwide suffer chronic pain (Deer et al., 2014). That means that 20% of the 2,215,929 U.S. nurses (443,185) may be experiencing chronic pain (U.S. Bureau of Labor Statistics, 2019). If nurses are in chronic pain, they cannot bring their entire caring presence to provide competent, loving patient care (Budhrani-Shani et al., 2016; Kemper et al., 2011; Sitzman & Craven, 2021). Such an inability to fully participate in one's personal and professional life leads to hopelessness and depression, which leads to burnout (Ahola &

Hakanen, 2014). The current estimated attrition rate among nurses in the next two years is 40% to 49% (LeClaire et al., 2022; Taylor-Clark et al., 2022). However, by providing nurses with supportive health resources, hospitals could see the retention of nurses and cost savings (Pipe et al., 2012; Summers et al., 2015; Robert Wood Johnson Foundation, 2009).

Contributing Factors of Chronic Pain

Chronic pain (CP) is a complex disease in which most patients suffer in silence. It is based on several contributing factors (Chen et al., 2018; Cornally & McCarthy, 2011; Gillsjö et al., 2020; Hellem, 2005; Saxena et al., 2018; Talleur, 2015). In a narrative review of systematic reviews from 42 countries, Mills et al. (2019) found that the risk factors that impact chronic pain globally are: gender, age, ethnicity, surgical interventions, ethnicity, socioeconomic status, and genetic factors (Anderson et al., 2009; Andersson et al., 1999; Wylde et al., 2017).

Globally, more girls than boys and more women than men voice chronic pain complaints (Miller & Abu-Alhaija, 2019; Richardson & Holdcroft, 2009). Similarly, in a meta-analysis of 86 studies with at least 1,000 participants, Steingrímsdóttir et al. (2017) found that 27% of females reported pain more frequently than men. Another study, with a sample of 931 women in ten countries, discovered that women suffer the consequences of endometritis in silence, which affects their work, relationships, and overall quality of life (De Graaf et al., 2013). In a review of 103 studies on gender variances in clinical experience, Unruh (1996) found that the main reason for differences in pain experiences between men and women are social role expectations for men and life experiences with pain for women. Although many women seek help, they report difficulty acquiring appropriate pain

management, as the medical establishment does not believe in their pain (Werner et al., 2003).

Age is another variable that impacts CP, as reports of CP increase with age and plateau between the ages of 70 and 75 (Cravello et al., 2019; Davis et al., 2004). This increase in CP is due to musculoskeletal disease reported by 25% of the adult population (Macfarlane, 2016), with lower back pain being the most prevalent of the musculoskeletal disorders (Summers et al., 2015), costing American $66,239 million per year (Waters & Graf, 2018). The increased reports of osteoarthritis for people over 54 (Villafañe et al., 2020) can also contribute to increased pain reporting with advanced age. Weakness in musculoskeletal systems results in a 30% fall rate among people over the age of 65, increasing CP (Zhao & Wang, 2016). Additionally, the presence of CP is underreported and mistreated in adults over the age of 65, which has consequences on the loss of mobility, falls, decreased daily activities, cognitive decline, and decreased quality of sleep and quality of living in the elderly (Cravello et al., 2019). According to the Institute of Medicine (2011), an effective pain management protocol must be tailored to suit the individual; otherwise increased CP leads to accelerated cognitive decline, falls, social isolation, and premature death (Cravello et al., 2019; Davis et al., 2004; Domenichiello & Ramsden, 2019).

Surgical interventions also cause chronic pain, affecting about 10% to 50% of patients after mastectomy, hysterectomy, joint replacement, back surgery, cardiac surgery, and thoracic surgery (Homma et al., 2018; Kehlet et al., 2006; Wylde et al., 2017). Surgical procedures that last longer than three hours have the potential for nerve injury and increase the risk of chronic pain (Gilron et al., 2019; Macrae, 2008). Chronic pain is not limited to

significant surgeries but also minor surgeries such as hernia repair (Reddi & Curran, 2014; Wylde et al., 2017). The effects of pain-related impairments related to post-surgical interventions range from a decline in cognitive functions, disturbed sleep, impaired cardio-respiratory functions, and gastrointestinal function (Gilron et al., 2019). The post-surgical experience of chronic pain depends on the patient's demographic, types of surgery, comorbidities, psychological and psychiatric factors, and physical functioning (Gilron et al., 2019). Current pharmacological interventions for chronic pain include opioids, antidepressants, antiepileptics, local anesthetics, and epidural injections (Gilron et al., 2019; Wylde et al., 2017).

Chronic pain is impacted by one's ethnicity (Anderson et al., 2009; Aroke et al., 2019). In the current U.S. population of approximately 331 million, 76.3% are white, 13.4% are Black or African, 1.3% are Native Indians or Alaska natives, 5.9% are Asian, 0.2% are Native Hawaiian, 2.8% are two or more races, and 18.5% are Hispanic or Latinx (U.S. Census Bureau, 2021). The definition of minorities, according to the National Institute of Health (NIH), is "a readily identifiable subset of the U.S. population, distinguished by racial, ethnic, and cultural heritage" (Anderson et al., 2009, p. 1118). Minorities, especially the African American population, report discriminatory treatment from care providers compared to non-Hispanic whites in the United States (Anderson et al., 2009; Aroke et al., 2019; Green & Hart-Johnson, 2012). One of the first studies exploring differences in patients who had undergone uncomplicated appendectomies found that white patients received significantly higher opioid doses postoperatively compared to minority patients (Anderson et al., 2009; McDonald, 1994). Factors that impact pain outcomes for patients in ethnic and racial

minority populations in the U.S. are access to care providers, lack of analgesics, miscommunication and misunderstanding by the care provider, and patient behaviors and beliefs (Riley et al., 2002; Shavers et al., 2010; Shepherd et al., 2018; Summers et al., 2015; Vanhaudenhuyse et al., 2018). Physicians spend more time with white inpatients than with minorities (Ly, 2019), especially African Americans, who are more scrutinized regarding their pain assessments and need for prescription medications (Maly & Vallerand, 2018). Biased treatment by healthcare providers is the number one barrier to providing adequate pain relief for minority populations (Anderson et al., 2009; Benjamins & Whitman, 2014; FitzGerald & Hurst, 2017; Marcelin et al., 2019; Paradies et al., 2013; Shavers et al., 2010), "even in circumstances that appear counter-intuitive" (Institute of Medicine, 2011, p. 69). The discriminatory treatment also extends to people of lower socioeconomic status (Hall et al., 2015; Maly & Vallerand, 2018; Mills et al., 2019; Shepherd et al., 2018).

Socioeconomic status, employment status, and occupational risk factors also contribute to chronic pain (Maly & Vallerand, 2018; Martinez-Calderon et al., 2019; Mills et al., 2019; Shepherd et al., 2018). Those who are uninsured and are of a minority population are also more at risk for chronic pain (Maly & Vallerand, 2018). Those who are unemployed report more chronic pain than those who are employed (Mills et al., 2019). For people living in the lower socioeconomic strata, healthcare decisions are weighted against other daily needs; therefore, prescriptions and ongoing care for chronic pain sufferers are often not prioritized (Institute of Medicine, 2011; Maly & Vallerand, 2018). People from lower socioeconomic status have to work longer hours in physically laborious jobs, which can result in further injury (Summers et al., 2015). Specific occupations such as mining,

manufacturing, home care, and nursing have the highest risk for workplace musculoskeletal injury resulting in chronic pain (Summers et al., 2015). Manual work, workplace injury, stress, lack of autonomy, and job satisfaction all increase normal pain levels (Martinez-Calderon et al., 2019; Mills et al., 2019; Summers et al., 2015). Working with chronic pain can increase the severity of chronic pain and lead to the development of another site of acute pain in the body (Mills et al., 2019). One of the essential ways to reduce chronic pain is by managing it when it occurs or preventing it from happening (Mills et al., 2019). However, people in lower socioeconomic neighborhoods do not have the choice to work or not and have decreased access to prescription pain medications, regular care providers, and pain specialists (Hussain et al., 2019; Institute of Medicine, 2011; Maly & Vallerand, 2018). Therefore, lower socioeconomic factors are adversely related to chronic pain (Institute of Medicine, 2011).

Another factor impacting chronic pain is a genetic predisposition (Mills et al., 2019). Genetic factors impact individuals' severity and experience of pain factors based on constitutional vulnerabilities (Hussain et al., 2019; Watson, 2012). According to the Institute of Medicine (2011), an individual's mitochondrial deoxyribonucleic acid (DNA) may alter the pain experience, especially in the peripheral nerves in the muscle tissue. The role of genes influences biological, behavioral, and emotional responses (Zorina-Lichtenwalter et al., 2016). The most investigated chronic pain disorders about genetics are migraine headaches and musculoskeletal pain (widespread chronic pain, lower back pain, fibromyalgia, and temporomandibular disorder (TMD) that have 50% genetic factors (Zorina-Lichtenwalter et al., 2016). Unlike musculoskeletal pain and migraines, neuropathic

pain comes from a rare familial mutation dominated by sodium channels, while several genes are responsible for chronic pancreatitis pain (Zorina-Lichtenwalter et al., 2016). These genetic studies contribute to multipath ways of treating pain effectively and safely (Institute of Medicine, 2011).

Another perspective in the literature is how lifestyle behaviors impact the intensity and recovery from chronic pain (Martinez-Calderon et al., 2019; Mills et al., 2019). Behaviors of smoking (Shi et al., 2010; Weingarten et al., 2011), lack of physical activity (Booth et al., 2012; Budhrani-Shani et al., 2015; Summers et al., 2015), poor nutritional intake (Brain et al., 2019), colder climates (Jamison et al., 1995), and the lack of vitamin D (Shipton & Shipton, 2015) are demonstrated to impact the experience of chronic pain (Budhrani-Shani et al., 2015; Bushnell et al., 2015; Martinez-Calderon et al., 2019; Mills et al., 2019).

When individuals who experience CP have pain in multiple locations, it has been found that the experiences of pain are affected by comorbidities (Dahan et al., 2014; Pagé et al., 2018), sleep disorders (Dahan et al., 2014; Kelly et al., 2011; Mathias et al., 2018), mental health disorders (Goesling et al., 2018; Harding et al., 2019; Hooten, 2016), weight (Okifuji & Hare, 2015), genetics (Aroke et al., 2019), interpersonal violence (Kelly et al., 2018; Hooten, 2016), and attitudes and beliefs (Summers et al., 2015; Vanhaudenhuyse et al., 2018). Additionally, if factors impacting CP are not mitigated, prolonged chronic pain challenges the body's homeostasis, leading to cognitive changes that potentially shorten the life expectancy of a chronic pain patient by ten years (Romano, 2014; Summers et al., 2015; Torrance et al., 2010; Villemure & Bushnell, 2002). In a study of 6,324 chronic pain

participants in the Manchester area, with a median age of 63, who had the above risk factors of smoking, comorbidities, lack of physical activity, uncontrolled weight, poor attitudes toward pain, functional limitations, and psychological and social factors, the mean survival rate after diagnosis was only 54.1 months (4.5 years; Summers et al., 2015). It is also known that chronic pain can lead to stress, which changes the neurological architecture and the chemistry of the brain and the body (McEwen, 2017; Timmers et al., 2018; Villafañe et al., 2020). These neurological changes are due to consistent stress effects: (a) psychosocially factors of increased anxiety, fear-avoidance, decreased empathy, interpersonal relationships, learning, cognitive, and information processing; (b) physiological factors of increased cortisol, insulin, other metabolic hormones, and inflammatory markers; (c) biological factors of increased pulse rate, medication intake (Avvenuti et al., 2020; Jinich-Diamant et al., 2020; Koenig et al., 2015; Lou et al., 2019; Lutz, Brefczynski-Lewis et al., 2008; Lutz et al., 2015; Lutz, Slagter et al., 2008; McEwen, 2017; Radley et al., 2015; Schneider et al., 2012; Talbot et al., 1991; Timmers et al., 2019).

Stress

Stress is defined as any stimulus that become taxing, overpowering, and unpredictable, impacting one's ability to perform personal and professional tasks (Bonezzi et al., 2020; Chesak et al., 2015; Cohen et al., 1983). According to Abdallah and Geha (2017), chronic pain and chronic stress are two sides of the same coin. The effect of chronic and acute stress affects the neurochemistry, the molecular profile, and the structural architecture of the brain (McEwen, 2017; Pardos-Gascón et al., 2021; Timmers et al., 2018; Villafañe et al., 2020). Changes due to acute or chronic stress can be seen in the thalamus, amygdala,

hippocampus, prefrontal cortex, and cerebral cortex (Lutz, Brefczynski-Lewis et al., 2008; Lutz et al., 2015; Lutz, Slagter et al., 2008; McEwen, 2017; Radley et al., 2015; Schneider et al., 2012; Talbot et al., 1991; Tang et al., 2015; Timmers et al., 2019). Changes in these areas impact the regular functioning of the cardiovascular, immune, and metabolic systems (Radley et al., 2015; Sapolsky, 2004; Timmers et al., 2019). These areas also play a pivotal role in regulating one's emotional experience. Alterations in emotional experiences may lead to changes in mental health in addition to increased levels of fear, depression, distress, and anxiety, negatively impacting one's mental health outlook and leading to social anxiety (Zautra, 2003). The unpredictable nature of chronic pain creates anticipation, which creates more stress, fear, and anxiety in healthy adult brains, impacting social interactions and work performance (Hölzel et al., 2016; Ploghaus et al., 2003; Talbot et al., 2009). The fear and stress related to the unpredictable nature of chronic pain can lead to isolation at work and decreased social engagement and activities (Bushnell et al., 2015).

In a study of 22 older adults with chronic knee pain in West Virginia, the chronic pain was noted to affect patients' stress levels, mood, and sleep patterns over time (Innes et al., 2018). When translating this to the workforce, it has been noted that lack of sleep and workplace stress affects employees' ability to maintain focus and adapt to the demands of the task at hand (Meiran et al., 1994). Pre-COVID nursing was stressful; according to a qualitative report of 21 nurse managers, the complexity of a regular workday "borders on chaos," causing "extreme stress" that negatively impacted their decision-making and potentially affected staff, patients, and health systems (Shirey et al., 2013, pp. 18, 28). The process of actively responding and attempting to regulate stress can be captured through

elevated or depressed cortisol levels (McEwen, 2017; McEwen et al., 2015). The effects of stress on a person's subjective well-being can be collected by self-reports such as the perceived stress scale (PSS) and through cortisol levels, which are evidenced-based measures that capture the physiological manifestation of stress (Atanes et al., 2015; Granger et al. 2009; Walvekar et al., 2015). However, during the COVID-19 pandemic, nurses reported they felt privileged to be part of something bigger, had extreme levels of increased stress related to the challenges of caring for high-acuity patients, increased mortality rates, and the lack of time to care for their own families (Eccleston et al., 2020; Specht et al., 2021; Zhang et al., 2020).

Cortisol

Cortisol is a steroid hormone manufactured from cholesterol by the adrenal cortex (Thau et al., 2019). Cortisol has many receptors in most body cells (Thau et al., 2019). The function of cortisol is to maintain well-being by controlling water-salt balance, reducing inflammation, regulating metabolism and blood sugar, playing a vital role in memory formation, and supporting fetal growth during pregnancy (Oakley & Cidlowski, 2013). Under normal conditions, this hormone is essential to promote health and welfare in the body (Bansal et al., 2016; Oakley & Cidlowski, 2013). However, in the presence of heightened stress, excess cortisol hormone is secreted during the body's fight or flight response; due to this trait, cortisol is often referred to as the "stress hormone" (Hodgson & Granger, 2013; Oakley & Cidlowski, 2013; Walvekar et al., 2015). This essential steroid hormone is vital to maintaining one's health and well-being but could lead to morbidity if its quantity is either

diminished severely or secreted excessively over prolonged periods (El-Farhan et al., 2017; Thau et al., 2019).

It is known that maladaptive stress responses can lead to changes that impact health, emotions, and overall well-being (Abdallah & Geha, 2017; Zautra, 2003). The effects of prolonged stress trigger the hypothalamic-pituitary-adrenal (HPA) axis and can be measured through cortisol levels (Dahan et al., 2014; Karhula et al., 2016; Matousek et al., 2010; Timmers et al., 2019). Cortisol can be measured through serum cortisol levels and are an accurate representation of the functioning of the HPA axis following adrenocorticotrophic hormone (ACTH) and corticotropin-releasing hormone (CRH) stimulation to perceived stress (Fernández-Sánchez et al., 2018). Salivary and urinary cortisol is consistent with serum-free cortisol levels and is a valid research tool for measuring stress reactions (Jung et al., 2014). The effects of a stressful event can be tested through self-reports with the perceived stress test. It is known that cortisol levels peak between 30 minutes to two hours after a stressful event but may stay heightened for several hours after the conscious or unconscious response (Fischer et al., 2000; Jung et al., 2014; Walvekar et al., 2015).

When evaluating the conscious and unconscious effects of stress in 112 nurses and 27 physicians in neonatal and pediatric critical care, it was found that salivary cortisol increased two hours after stressful incidences. Interestingly, 71.3% of the high cortisol readings occurred without the participants' conscious awareness that they were experiencing any stress (Fischer et al., 2000). In a similar study of 69 nurses, doctors, and nursing assistants, Fernández-Sánchez et al. (2019) found that salivary cortisol levels, psychopathology, and stress indexes were significantly higher in professionals who reported experiencing burnout.

Additionally, a study examining on-the-job stress among 57 nurses in the Unified Health System of Campinas in São Paulo, Brazil, showed elevated cortisol levels during workdays (Pires da Rocha et al., 2013). The average cortisol range of the participants was 564.1 ng/m, with groups of 354.1 ng/mL on days off and 638.1 ng/mL during the workday, indicating a correlation between job-related stress and cortisol levels (Pires da Rocha et al., 2013).

Conversely, calming activities such as meditation, relaxation, or dog therapy were found to lower serum and salivary cortisol levels at Virginia Commonwealth University (Barker et al., 2005). The baseline serum cortisol levels were within range (10.3-13.8 µg) and dropped 85.8% in five minutes and 77.4% below baseline at 20 minutes following dog therapy (Barker et al., 2005). From these studies and others within the literature, it can be noted that cortisol levels are a valid marker of response to a stressor in the body of healthcare workers (Barker et al., 2005; Fernández-Sánchez et al., 2019; Fischer et al., 2000).

Pulse Rate and Physiological Indicators

The pulse rate is defined as the pressure wave transmitted through the arteries due to each contraction of the heart (Marieb & Hoehn, 2007). Pulse rate is another physical measure that can be collected in addition to cortisol levels to assess for stress. The pulse rate is an indicator of pain signals as a biologically bodily threat that urges the person to protect themselves again from the sources of the danger of pain, thus engaging in avoidance of pain and safety-seeking behaviors (Vlaeyen et al., 2016). These safety-seeking behaviors to escape pain and find homeostasis increase the load on the central systems that regulate cardiovascular functions and increase heart rate, pupil diameter, blood pressure, and plasma cortisol levels (Appelhans et al., 2008; Cowen et al., 2015; Dayoub & Jena, 2015; Koenig et

al., 2016; Rathmell & Fields, 2012; Vlaeyen et al., 2016; Xiao et al., 2018). These physiological indicators also adapt to the presence or absence of pain (Melzack & Katz, 1994). The presence of pain also causes an increase in blood pressure and heart rate via the sympathetic (autonomic) nervous system response that is stimulated by electrical pain signals that reach the central nervous system (Ahn, 2010; Kraaij et al., 2020; Möltner et al., 1990; Talbot et al., 1991; Tousignant-Laflamme et al., 2005). These painful sensations also signal the pituitary and hypothalamus and release adrenocorticotropin hormone (ACTH), which activates the adrenal glands to release adrenalin, causing the elevation in pulse and blood pressure (Koenig et al., 2016; Rathmell & Fields, 2012; Saccò et al., 2013). The autonomic nervous system activation of heart rate and blood pressure increases may be cues about pain and thus may be used as evaluation tools for pain (Pudas-Tähkä et al., 2009; Tousignant-Laflamme et al., 2005).

Support for using pain assessment tools is based on several evidence-based resources. First, in the systematic review of 58 studies on pain assessment tools for unconscious patients, it was noted that increased heart rate and blood pressure indicated pain (Pudas-Tähkä et al., 2009). A second study on nonverbal patients was conducted with ten premature infants. Pulse rate and oxygen saturation via pulse oximeter were used as indicators of pain intensity while lying skin to skin with the mother or lying in the crib or incubator during venipuncture. Heart rate increased at an average rate of 8.4 beats per minute, and oxygen saturation decreased by 1.3% in both groups during venipuncture, indicating pain (Olsson et al., 2016). A third evidence-based resource is a systematic analysis of 299 studies on distraction as a pain management technique for pediatric patients (Bukola & Paula, 2017).

Additional research, a meta-analysis of four studies with 220 pediatric participants, showed that distraction effectively reduced procedural pain through self-reported pain (Bukola & Paula, 2017). In a meta-analysis of 13 RCTs on the use of virtual reality (VR) during dressing changes in 362 burn victims, two VR studies with 65 patients were found to decrease heart rate and pulse rate, which indicated a reduction in time pondering pain, pain intensity, and unpleasantness when compared to the use of just analgesics (Lou et al., 2019). In an RCT study with 39 healthy male subjects undergoing a six-second heat stimulus, heart rate compared to skin conductance was a more accurate predictor of pain ratings (Loggia et al., 2011). Therefore, based on the evidence, heart rate is considered an evidence-based tool to assess pain (Tousignant-Laflamme et al., 2005), considered the fifth vital (Cowen et al., 2015; Institute of Medicine).

Medication Intake

Medication intake is defined as the extent to which the patient's self-report of taking medication corresponds with the healthcare provider's recommendations (Russell et al., 2006; Sabaté, 2003). In the 10-year review from 2000 to 2010, 20.7% of doctor's office visits, or 1,616 million out of 7,802 million visits, were for the treatment of chronic pain. (Daubresse et al., 2013). In 2010, 46.65% of these patients experiencing CP were treated with pain medications that included topical therapies, local injectables, muscle relaxants, tricyclic antidepressants, gabapentin, pregabalin, anti-inflammatory agents (NSAIDs), acetaminophen, and opioids (Daubresse et al., 2013; Portenoy et al., 2007; U.S. Department of Health and Human Services, 2000). However, the effectiveness of these pain medications on CP often depends on the interplay of beliefs, and biological, social, and psychological

factors that are further impacted by the patient's gender, race, social, and ethnicity, which inform their beliefs about the use of pain medications (Daheim et al., 2020; Fillingim, 2009; Schieffer et al., 2005; Schneider et al., 2012). The amount of medication patients take is also based on attitudes and beliefs influenced by cultural and ethnic influences (Anderson et al., 2008; Fillingim et al., 2009; Summers et al., 2015; Vanhaudenhuyse et al., 2018). Medication intake is very complex and individualized, and the response to medication is also individualized.

Sex and Gender

The biological sexes of male and female and the sociocultural definitions that overlay femininity and masculinity influence medication use and pain relief (De Graaff et al., 2013; Richardson & Holdcroft, 2009). Gender differences also sway how illness is expressed (Werner & Malterud, 2003). In the Cochran review of five systematic studies, most chronic pain study participants were female, with a mean age of 49.63 and an average chronic pain duration of 12.68 years (Eccleston et al., 2020). Additionally, it was found in 10 population-based studies across the United States that women verbalize more pain in the facial, abdominal, chest, and back areas, as well as more post-surgical and arthritic pain, resulting in women reporting more chronic pain (21.6%) than men (16.2%) (Fillingim, 2019). However, in a sample of chronic pain patients (N = 716), males were found to report higher pain ratings ($p < 0.001$) and more days with pain ($p < 0.001$) when compared to women (Marcus, 2003). The differences in the pain between the sexes are influenced by sex hormones and psychosocial and cultural components (Fillingim, 2019; Richardson & Holdcroft, 2009; Robinson et al., 2001). Although women report gender bias in their pain medication

approaches and take more medications than men, they report poorer relief from pain medications (LeResche et al., 2015; Richardson & Holdcroft, 2009; Werner & Malterud, 2003). However, no differences were noted in a review of 16 epidemiologic studies between analgesic intake and relief of pain between males and females (Fillingim et al., 2009).

Cultural and Ethnic Influences

A person's cultural and ethnic background influences their beliefs about anatomy, health, illness, and the need for treatments and medications (Berlin et al., 1983). Racial and ethnic backgrounds influence the need, response, and compliance with pain therapy (Anderson et al., 2008; Summers et al., 2015; Vanhaudenhuyse et al., 2018). Culture is defined as traditions, social norms, customary beliefs, and expectations, while ethnicity refers to a designated cultural and social grouping of people within a society (Anderson et al., 2008; Shavers et al., 2010). The attitudes about pain and medications are deeply rooted in one's culture, religion, and spiritual beliefs (Andersson et al., 1999; Shavers et al., 2010). Patients from expressive cultures can better describe the pain, and those from stoic cultures do not freely admit to pain (Shavers et al., 2010). For example, Asian Americans do not report pain because their culture values stoicism and does not encourage complaints about pain (Institute of Medicine, 2010). Comparatively, in a cross-cultural survey of pain appropriateness with a sample of 64 Japanese Americans (32), and European Americans (32), European Americans accepted pain in women. However, European American men did not accept pain in other men, whereas Japanese Americans did not accept pain in either gender (Hobora, 2005).

It has been noted that Mexican Americans, American Indians, Alaska Natives, African Americans, and people with no health insurance, less education, and a lower income

report multiple locations of pain and higher pain ratings but may not accurately communicate this to their healthcare providers (Institute of Medicine, 2010). Patients from minority ethnicities do not wish to be perceived as complainers and may not verbalize pain, which is the principal barrier to adequate pain management (Cleeland et al., 1997; Fillingim et al., 2019; Institute of Medicine, 2010). In a systematic analysis of 26 studies, factors that contributed to not seeking pain medications were fear and anxiety in seeking medical treatment, lack of resources or knowledge, costs, and social influences (Cornally & McCarthy, 2011). It is also known that anxiety heightens and alters the need for pain medication, which may also contribute to higher pain ratings (Schieffer et al., 2005).

Analgesics are the most common medication for chronic pain (Andersson et al., 1999). When people did report pain, studies have found that analgesic treatments to African American and Hispanic patients are provided less frequently and at a lower dose than non-Hispanic whites (Anderson et al., 2008; Hollingshead et al., 2016; Institute of Medicine, 2010). These disparities in pain management may be due to the healthcare providers' ethnic background, bias, and inability to effectively communicate with patients (Anderson et al., 2008; Institute of Medicine, 2010). Adherence to prescribed medications determines patients' well-being and health outcomes; therefore, culturally sensitive materials and pain management programs are needed to provide equality in pain management (Burton & Shaw, 2015). Although sex, gender, ethnicity, culture, and belief play a role in seeking pain management, tracking compliance with medication intake can be considered a form of self-care, especially during chronic illness (Anderson et al., 2008; Andersson et al., 1999; Conn & Russell, 2005). Adherence to prescribed medication is not only a form of self-care, but also a

form of self-compassion (Friis et al., 2015). Providers can be made aware that research with MBI has demonstrated that there is a reduction in the use and abuse of pain medication for all patients with CP across all ages and cultures (Arnstein et al., 2017; Cohen et al., 2005; Garland et al., 2020; Hilton et al., 2017; Innes et al., 2018; Jinich-Diamant et al., 2020; Ludwig & Kabat-Zinn, 2008).

Self-compassion

Self-compassion is defined as being open to one's suffering, expressing feelings of caring and kindness toward one's perceived inadequacies and failures in a non-judgmental, compassionate manner, and recognizing that our experience is not unique but a common human experience (Neff, 2003). The presence of persistent, unmanaged, chronic pain can negatively affect the body, spirit, and mind, impacting psychological and emotional behaviors (Arnstein et al., 2017; Davis & Zautra, 2003; Wren et al., 2011). During chronic pain, the person tries to regulate and control pain responses, leading to a perceived loss of control, self-esteem, and lack of self-care (Costa & Pinto-Gouveia, 2011). However, having to learn to live with the pain "should not be the end of the road, it should be the beginning" (Hahn & Kabat-Zinn, 2009, p. 286) of learning what is best for us with patience, kindness, and self-compassion. The role of self-compassionate actions is critical as it promotes patients' health-seeking behaviors even in the presence of pain and has a protective factor against adverse health outcomes such as chronic pain, with compassionate actions prolonging the effects of the meditation (Altman et al., 2020; Carvalho et al., 2018; McCracken et al., 2004; Stanford, 2013; Zhang et al., 2020).

Self-compassion helps bring emotional equilibrium in uncertain events (Leary et al., 2007; Neff et al., 2011). Emotional regulation in response to pain can be achieved when there is dynamic equilibrium. Consistent meditation will allow the person with CP to moderate pain and maintain the capacity for emotional regulation (Hölzel et al., 2011; Wu et al., 2019; Zeidan et al., 2011; Zorn et al., 2020). The practice of meditation has been demonstrated to increase activity in brain regions responsible for self-compassion and empathy (Hölzel et al., 2013; Lutz, Brefczynski-Lewis et al., 2008). A study evaluating 88 patients and their self-compassion found, via the Self-Compassion Scale (SCS), that self-compassion was a significant predictor of pain catastrophizing ($p = 0.003$), pain disability ($p < 0.05$), negative effect ($p < 0.001$), and positive affect ($p = 0.01$) (Wren et al., 2019). The systematic review and meta-analysis of 22 Random Controlled Trials by Wilson et al. (2019) found that self-compassion had a moderate impact on stress, anxiety, and depression in adults across all the studies. Wilson et al. (2019) suggested that self-compassion-based therapies could benefit clinical and non-clinical populations. Additionally, a small pilot study of Midwestern public school teachers (n=15) found that meditation increased self-compassion scores and reduced attentional biases, burnout, and psychological symptoms, while increasing effective teaching behavior (Flook et al., 2013).

The concept of self-compassion in nursing is not a new one. Watson's Caring Science theory supports self-compassion and its impact upon not only nurses but upon their patients. Self-compassion creates a healing and growing environment of care for the nurse and patient (Nelson & Watson, 2012; Sitzman & Watson, 2018). It has also been demonstrated that self-compassion can be taught and learned by being open, vulnerable, non-judgmental, voicing

needs, and accepting compassion, which sustains caring in the nursing profession (Watson, 2014; Wiklund-Gustin & Wagner, 2012).

Studies evaluating mindfulness-based stress reduction (MBSR) report improved self-care, reduced stress, and increased patient care (Brady et al., 2012). At the same time, other studies reported increased feelings of empowerment and self-learning (Birnbaum, 2008) and increased feelings of personal accomplishment (Cohen-Katz et al., 2005). Similarly, MBSR increased self-care and resiliency (Craigie et al., 2016), managed stress, improved self-compassion, and improved patient care (Mahon et al., 2017). In a recent study, adapted MBSR was effective in reducing depression, anxiety, pain catastrophizing, and musculoskeletal pain ($p < .001$) and increasing self-compassion and quality of life scores ($p < 04$) in 64 nurses (Lopes et al., 2019). The interventions demonstrated the effective use of meditation among working nurses, with self-compassion positively correlated to professional caring, mental health, and personal well-being (Lopes et al., 2019). Therefore in patients with CP, instead of pushing away the pain, the approach of validation of the feelings of uncertainty, inviting the pain in, recognizing that all human beings share suffering, and allowing oneself to accept this unpleasant experience may be seen as acts of self-compassion (Kabat-Zinn & Hahn, 2009; Neff & Germer, 2018; Priddy, 2018). “When we hold our pain in this way, we start to transform and heal” (Neff & Germer, 2018, p. 2).

Professional Caring

Professional caring is defined as intentionally providing “technical, emotional, mental, aesthetic, humanistic, ethical care” that creates a space for healing (Watson, 2011, p. 78). Stress, chronic pain, and cortisol are often intertwined and can impact work

productivity and quality of care (Bonezzi et al., 2020; Fernández-Sánchez et al., 2019; Fischer et al., 2000). Recently, nurses' stress has increased due to the impacts of COVID-19, leading to an increase in pain, burnout, anxiety, and distress, as well as lack of compassion (Eccleston et al., 2020; Shah et al., 2021; Sitzman & Craven, 2021; Specht et al., 2021; Yifan et al., 2020). Pre-pandemic, chronic pain was directly correlated to concerns about professional duties, quality of life, family and interpersonal relationships, and personal recovery (Jinich-Diamant et al., 2020; Nie et al., 2015; Roy, 2006; van Agteren et al., 2021). The persistent chronic pain, stress, and increased cortisol levels affect the limbic system's optimum functions and prefrontal cortex, where executive decisions are formed (Gard et al., 2012; Martinez-Calderon et al., 2019; Timmers et al., 2019). These neurologic impacts result in a lack of engagement, meaning, focus, and productivity, leading to burnout and impacting general well-being (Ferreira et al., 2021; Moreira et al., 2020; Rosso et al., 2010;). The increased sense of stress and burnout leads to self-reported less than adequate patient care (Wren et al., 2011), which leads to decreased patient satisfaction scores (Letvak et al., 2012; Shapiro et al., 2005).

A survey of 895 nurses from four hospitals working in the Gauteng Department of Health in Monash, South Africa, reported that work-related stress led to job dissatisfaction and burnout, which impacted their overall health. These nurses reported somatic symptoms of "been feeling run down," "been getting pains in the head," "lost much sleep over worry," "feeling nervous and strung up all the time," "taking longer on things," "feeling worthless," and "life is hopeless" (Khamisa et al., 2015, p. 656). These feelings of psychological distress have been heightened during COVID-19 in nurses and can affect cardiac health leading to

systemic inflammation, sleep disturbances, and compounding overall health risks (Schneider et al., 2012; Shechter et al., 2021). These symptoms are also heightened during chronic pain and impact work productivity and quality of life (Alonso et al., 2004; Bonezzi et al., 2020; Wakim, 2014). Therefore, nurses who are ill-health stressed and in chronic pain, in addition to working during a pandemic, cannot provide care to the best of their abilities (Budhrani-Shani et al., 2016; Kemper et al., 2011). However, developing valued self-care activities, such as creating a warm, kind attitude, can reverse the effects of chronic pain-induced disturbance in health (Carvalho et al., 2018). These self-care actions are considered a "protective armor" against pain effects, ultimately impacting patient care (Penson et al., 2000, p. 427).

In a systematic review with a meta-analysis of 22 randomized controlled trials (RCT) of Loving Kindness Meditation with 1,747 participants, it was found that meditation decreased depression and increased compassion, self-compassion, and mindfulness, and thus impacted participants' general well-being and health (Galante et al., 2014). Additionally, another RCT of an MBSR intervention with 51 healthcare professionals from Menlo Park and Palo Alto Veterans Affairs Health Care System found participants decreased stress and increased self-compassion, increased life satisfaction, and increased compassion for their patients and coworkers themselves (Shapiro et al., 2005).

Key Points on Chronic Pain

In the previous section, the literature demonstrated that chronic pain affects stress, cortisol, pulse, medication intake, self-compassion, and professional caring (Abdallah & Geha, 2017; Kamper et al., 2015; Khamisa et al., 2015; Mills et al., 2019; Summers et al.,

2019). It is known that contributing factors to chronic pain range from genetics, racial profiling, cultural differences, education, income, and work-related injuries. Chronic pain is the number one reason for family doctor visits (Anderson et al., 2009; Andersson et al., 1999). During the Coronavirus 2019 (COVID-19) pandemic and pandemic response, access to pain interventions and services slowed and reached a standstill for all chronic pain patients, including healthcare workers (Eccleston et al., 2020). During the COVID-19 pandemic, nurses cared for patients with high acuity. They experienced staffing shortages and a shortage of supplies, which further contributed to increased stress, pain, and physical injury (Eccleston et al., 2020; Shechter et al., 2020; Zhang et al., 2020). Even pre-COVID, such workplace stress and injury affected professional and personal lives (Deer et al., 2014; Nelson & Baptiste, 2006). The professional stressors faced by nurses included increased workload, lack of control over assignments, and insufficient recognition (Eccleston et al., 2020; Griffin et al., 2020; Janssen et al., 2020; Pipe et al., 2012; Specht et al., 2021; Yifan et al., 2020). These professional stressors lead to physical problems of increased anxiety, hopelessness, depression which can lead to insomnia, headaches, muscles pain, and exhaustion and contribute to decreased empathy and quality of care and increased medication errors, accidents, and burnout (Alderson et al., 2015; Budhrani-Shani et al., 2016; Dueñas et al., 2016; Griffin et al., 2020; Hooley et al., 2014; Karhula et al., 2016; Sleed et al., 2005). Critically, if the original cause of nurses' chronic pain is left untreated, it changes structures in the brain and the nervous system, affects physiology and evolves beyond the original cause to become a different condition of its own (Fine, 2011; Zeidan et al., 2011). These changes may lead to attrition from the workforce. Attrition results in tangible costs of nurses'

chronic pain ranging from $36,567 to $40,038 annually in an average U.S. hospital (Colosi, 2021; Robert Wood Johnson Foundation, 2009). The intangible costs of attrition, lack of self-esteem, hopelessness, loss of control, dissatisfaction, burnout, and suicide are immeasurable (Alderson et al., 2015; Budhrani-Shani et al., 2016; Dueñas et al., 2016; Griffin et al., 2020; Hooley et al., 2014; Karhula et al., 2016; Sleed et al., 2005).

Therefore, it should be imperative to help nurses manage their chronic pain and stress levels through self-care modalities before these stressors hinder information processing in social settings and affect professional environments (Abdallah & Geha, 2017; Davis & Kotowski, 2016; Vuori et al., 2014). Self-care modalities like meditation-based interventions are seen as protective factors to guard against chronic pain and stress (Altman et al., 2020; Carvalho et al., 2018; McCracken et al., 2004; Norman et al., 2016; Penson et al., 2000). By investing in nurses' health and increasing their retention rate by 1%, healthcare systems could see savings of $270,800 to $306,400 annually (Colosi, 2021; Kress et al., 2015; Robert Wood Johnson Foundation, 2009).

Encouragingly, studies show that both short-term and long-term meditation-based interventions have the potential to address chronic pain positively, decrease stress and salivary cortisol levels, and improve self-compassion, professional caring, and quality of life (Hilton et al., 2017; Martinez-Calderon et al., 2019; Neff et al., 2020; Shonin et al., 2015). Therefore, it is reasonable to consider the positive impact of interventions to address chronic pain, decrease stress, alter salivary cortisol levels positively, and allow nurses to improve their self-compassion, leading to improved professional caring and quality of life.

Meditation

History

Meditation varies in definition, practice, and techniques (Ruff, 2019; Sharma, 2015). The history of meditation-based interventions for physical discomfort can be found in all ancient cultures and religious traditions (Loizzo, 2016). The practice of focusing one's mind can also be found in all shamanic cultures of the world (Taylor & Piedilato, 2002). The first grainy lithograph images that show what the Temple of Zhuzuan, a meditation hall, might have looked like were published in a European magazine on January 1, 1125. Similar images can be found in ruins from 5000 to 3,500 BCE in Egypt and India depicting teachings on meditation (Ashby, 1997; Aurelius, 2003). According to ancient traditions, the meditation instructions were passed orally from master to pupil, but the traders on the silk trade roads took this Eastern practice around the world (Ashby, 1997; Lizzio, 2014). The action of mindfulness is at the core of all Buddhist meditative practices as taught by the Buddha in 500 BC and was kept alive at the Buddhist University of Nalanda of ancient India and has been practiced in Asia since then (Kabat-Zinn, 2006; Liozzo, 2014).

A novel about the life of Siddhartha (who later was known as the Buddha), published in 1922, became popular in western literature and introduced readers to the term meditation (Hesse, 1922). In 1893, Swami Vivekananda further explained to the audience of the west what the practice was about, in a lecture held at the World Parliament of Religions in Chicago (Murphy et al., 1997). The American public became familiar with the term *meditation* when President Coolidge invited Paramahansa Yogananda, founder of Self-Realization Fellowship, to the White House on January 24, 1927 (Valone, 2009). In 1958,

Maharishi Yogi started teaching Transcendental Mediation Practices in the West (Mason, 2015). The great Zen Master Thích Nhất Hanh lectured on Comparative Religion at Princeton University in 1961. He was nominated by Dr. Martin Luther King, Jr. for the Nobel Peace Prize in 1967 for his work to bring peace and end the Vietnam war (Andrus, 2021).

The popularity of this newfound interest in ancient meditation tradition intrigued researchers who studied persons who follow the practices and philosophy of yoga and were able to control their pulse, respiration, and responses to cold weather. In the late 1950s, research found through ECT that Yogis could control their blood pressure and stress hormones when exposed to cold, loud noises, and vibrations (Anand et al., 1961; Wenger et al., 1961). In 1972, Wallace and Benson found meditation produces a wakeful hypometabolic state with similar effects as deep sleep or hypnosis, with a reduced rate of volume of respiration, oxygen consumption, carbon dioxide elimination, decreased blood-lactate level, slowed heartbeat, increased skin resistance, and slowed alpha waves as seen on EEG (Wallace & Benson, 1972). In a similar study with 60 adults, meditation reduced psychophysiological stress outcomes of skin conductance, self-reports, personality scales, and heart rate (Goleman & Schwartz, 1976).

Research on several forms of meditation has been conducted worldwide (Ruff, 2019; Sharma, 2015). Meditation is known by many definitions, but it is widely understood as the practice of focusing one's mind on an object, a thought, a mantra, or a feeling. It can be found in all ancient cultures of the world (Sharma, 2015; Taylor & Piedilato, 2002). According to Vedic traditions, the primary purpose of meditation is to connect oneself to

one's deeper inner self; therefore, any practices that allow one to achieve this goal serve the true meaning of meditation (Sharma, 2015).

Meditation-based interventions (MBIs) have also shown a statistically significant reduction in stress, cortisol, and compassion fatigue and an increase in self-compassion and resiliency among many professionals, including, but not limited to, working nurses and student nurses (Bonamer & Aquino-Russell, 2019; Mahon et al., 2017; Shapiro et al., 2012). The only published study currently found in the literature regarding nurses and mindfulness was conducted by Lopes et al. (2019), who found, in a sample of 64 nursing professionals in Brazil, that a 6-week adapted MBSR program was effective in reducing depression, anxiety, pain catastrophizing, and musculoskeletal pain ($p < .001$). Moreover, increased self-compassion and quality of life scores ($p < 04$) were also found as outcomes. Self-compassion strongly predicts professional caring, mental health, and well-being (Lopes et al., 2019).

Types of Meditation

In the following pages, an explanation of a few methods of meditation found in the literature are presented for clarification and understanding, as well as evidence supporting their outcomes on the practitioner.

Vipassana Meditation (VM)

The practice of Vipassana was taken out of the monasteries of Burma to offer some internal control to the layperson under foreign, oppressive British rule (Houtman, 1990). Vipassana meditation is based on Theravada Buddhist traditions and is the root of all mindfulness meditations (Baer, 2014; Guillaume et al., 2020; Hölzel et al., 2011). Its fundamental teachings focus on one's breath to develop sustained attention, perform

systematic body scans with non-reaction and detachment to experiences and sensations, followed by Loving Kindness Meditation towards self and others (Szekeres & Wertheim, 2015). In an RCT with adult volunteers in Australia, control (n = 50) and intervention (n = 122) found that VM reduced stress and increased self-kindness, well-being, and mindfulness in the intervention group (Szekeres & Wertheim, 2015).

Mind Programme (MP)

This type of meditation helps create body awareness and cognitive diffusion, and values clarification, self-care, compassion, acceptance, forgiveness, and committed action (Trindade et al., 2020). In an RCT with (n = 32) breast cancer patients, MP was found to reduce depression, stress, anger, and anxiety while improving physical health and social relationships (Trindade et al., 2020).

Psychoneuroendocrinoimmunology-based Meditation (PNEIMED)

While the Vipassana meditation uses Theravada traditions, PNEIMED uses the Mahayana Buddhist traditions and adds the chanting of mantra with inspirational words, then letting go of the emotions (Bottaccioli et al., 2014). Psychoneuroendocrinoimmunology-based meditation (PNEIMED) requires 30 hours of in-person, specific didactic training (Bottaccioli et al., 2014). In an RCT with students (n = 40), PNEIMED reduced mean salivary cortisol and stress levels in the intervention groups. The mean salivary cortisol levels from five minutes pre-test task of 4.57 $\pm$ 3.7 to 3.13 $\pm$ 2.2; 10 minutes pre-task was 6.32 $\pm$ 5.5 to post-task was 4.55 $\pm$ 3.8, and 30 minutes pre-task was 6.42 $\pm$ 3.9 to the post-stress job was 4.53 $\pm$ 2.3. The mean stress levels were 9.42 (preintervention) to 5.64 (postintervention)

in the intervention group. The cortisol and stress levels correlations between groups were significant, $F = 5.326$; $p = 0.032$ (Bottaccioli et al., 2014).

Mantra Meditation (MM) and Listening to Music (LM) Program

The practice of MM can be performed by selecting a mantra with deep spiritual meaning, a preferred sound, a vibrational quality, or one with no meaning. The practitioners are first instructed to repeat the mantra with ease and effortlessness while letting go of stress and taking deep breaths for 15-20 minutes. The second step is to stop repeating the mantra while sitting quietly for approximately two minutes, then slowly open your eyes and resume daily activities (Innes et al., 2018). Furthermore, adding Music Meditation impacts the control group as music elicits an analgesic response for chronic pain (Garza-Villarreal et al., 2017; Innes et al., 2018). In an RCT with a sample of 22 with osteoarthritis, chronic pain, perceived stress, knee dysfunction, and decreased quality of life, the mantra meditation was found to reduce pain and use of meditations, improvement in mobility, clarity, focus, mood, and quality of sleep (Innes et al., 2018).

Sufi

Sufi meditation teaches the practitioner to concentrate on any one idea or object and not pay attention to other ideas or objects. For example, they sat upright in a quiet place and visualized Allah's name (personal name of God) on a red or green colored card for five minutes with specific blinking of the eyes. Then with imaginary white or gold glitter ink, the practitioner writes the precious name on the heart with an index figure for 10 minutes (Gul & Jehangir, 2019). An RCT of women (n= 100) with moderate to high anxiety disorder found that the intervention group, which used visualization and writing activities, demonstrated

lowered anxiety and stress, increased well-being, spirituality, and decreased worldly dependence (Gul & Jehangir, 2019).

Straighten the Back to Sit to Cultivate Belly

This practice provides *suwari* (steadily grounding oneself to the earth for stability) and offers quietness to harmonize the mind with rhythmic breathing to develop a strong belly, which, according to the ancient Japanese, was the abdominal brain or the abdominal heart, which could be activated by massaging the area with deep breaths (Wu, 2016). Deep breathing started the celiac plexus, the most extensive nervous plexus of the nervous system, which they believed influenced breathing, nutrition, and mental functions (Wu, 2016). The ancient Japanese believed that the abdominal heart influenced the health of all other organs (Wu, 2016). Sitting quietly and breathing into the belly deeply was known to help with emotional disturbances, irritability, fatigue, and headache, which were believed to be disorders of the *qi*, now known in modernity as the cardiovascular and nervous systems (Wu, 2016).

Transcendental Meditation (TM)

This practice is defined as a mental process of transcending the self, using a secret silent mantra for 20 minutes to be practiced twice a day (Avvenuti et al. 2020). In a study of 19 people with insomnia, stress, and anxiety, TM significantly reduced anxiety, depression, and psychological distress, as well as increased resilience, quality of life, self-determination, self-esteem, and assertiveness that correlated to several positive structural changes in the brain (Avvenuti et al. 2020).

Mindfulness-based Cognitive Therapy (MBCT)

This practice is designed to break the constant stream of negative feelings, thoughts, and physical sensations by performing body scans, affirmations, moment-to-moment awareness of breath and body, mindful walking, stretching, yoga, and sitting meditation, and a 3-minute breathing space (Murphy & Lahtinen, 2015). In a qualitative study of six psychiatric patients in London, MBCT was found to cause balanced thoughts, productive actions, and experiencing the neutral mind (observing thought and choosing to respond and think differently). “It’s stopped that from happening going into the deep hole and not knowing how to come out. It’s a kind of miracle, really!” (Murphy & Lahtinen, 2015, p. 7). Mindfulness-Based Cognitive Therapy (MBCT) reduces experiential avoidance, rumination, suicidal tendency, self-criticism, stress reactivity, and self-criticism (Murphy & Lahtinen, 2015).

Osho Dynamic Meditation

This practice is a 60-minute, 5-stage, formatted meditation technique. Stage one: rapid, chaotic, deep breathing for 10 minutes while jumping. Stage 2: 10 minutes of emotional catharsis. Stage 3: 10 minutes of shouting and jumping, repeating the mantra “hoo.” Stage 4: 15 minutes of silence. Stage 5: 15 minutes of celebration through dance. During these steps, the practitioner observes oneself as a silent witness without emotions (Bansal et al., 2016). An RCT of 16 participants found a reduction in cortisol ($p < 0.0001$), aggression, trait anger, somatic complaints, anxious-depressive syndrome, and enhancement in self-esteem (Bansal et al., 2016).

Mindfulness-based Stress Reduction (MBSR)

This practice heightens awareness that emerges by paying purposeful attention to the present moment and accepting the thoughts that arise without resistance or judgment (Kabat-Zinn, 2003). The first MBSR program was based on a noncontrolled clinical trial of this 10-week program for 51 subjects with chronic pain. The study found that meditation caused an uncoupling of the sensory perceptions of the pain experience and a reduction in the experience of suffering via cognitive reappraisal (Kabat-Zinn, 1986). The study was replicated by a similar four-year-long qualitative observational study in a sample of 225 people, with results showing significantly reduced pain-related stress. Participants were better able to cope with pain-related stress and physical pain, as well as gained the ability to use their breath to attenuate pain signals. Others reported a new outlook on life (Kabat-Zinn et al., 1986). The highest compliance rates had the most significant improvement in pain, and low compliers experienced increased pain-related stress levels within a year (Kabat-Zinn et al., 1986).

Loving Kindness Meditation (LKM)

LKM is a traditional Buddhist-based meditation practiced formally or informally during daily living and helps one cultivate an attitude of mindfulness, unconditional love, and compassion towards oneself and others (Boellinghaus et al., 2014; Houtman 1990; Taylor, 2013). Mindfulness is described as a psychological focus with non-judgment at the moment (Gilbert, 2005; Kabat-Zinn, 1994). Compassion is a cognitive understanding of suffering without judgment and taking practical steps to alleviate this suffering (Bishop et al., 2004; Gilbert, 2010). Unconditional love is accepting the good and the painful parts of oneself and

others without wanting to change (Salzberg, 1995). Compassion differs from mindfulness because it asks one to observe suffering and act intentionally to relieve it (Boellinghaus et al., 2014; Gilbert, 2010; Sandford, 2013). Compassion differs from unconditional love because compassion focuses on suffering and unconditional love in all aspects of life (Salzberg, 1995; Sandford, 2013). Loving Kindness Meditation is based on traditional Buddhist principles and can help a practitioner cultivate attitudes of compassion towards others and self as well as kindness and unconditional love towards all (Gilbert, 2005; Salzberg, 1995).

Many of these traditions of meditation and self-care come from historical knowledge and wisdom. Based on the findings of the various studies, one should consider the impact of these practices on individuals and individuals living with chronic pain. It stands to reason that the development of mindfulness, unconditional love, and compassion can help healthcare workers reduce fatigue, distress, and burnout while enhancing empathy and reducing the chances of empathetic pain, fatigue, and burnout (Boellinghaus et al., 2014). These studies of meditation-based interventions are termed MBIs (Baer, 2014).

Various forms of MBIs were found to impact pain, including physical and psychological problems positively, and increase general well-being in all ages involving children, teenagers, adults, and geriatric populations (Baer, 2014; Carlson, 2012; Chen et al., 2018; Jong et al., 2017; Kim et al., 2019; Ruskin et al., 2017; van Agteren et al., 2021). Systemic and meta-analyses found that self-care through MBI actions of physical exercise, yoga, and cognitive-based behavioral therapy reduced chronic pain outcomes such as stress and increased personal and professional satisfaction (Bauer et al., 2016; Cheng & Cheng, 2019; Donahue et al., 2021; Khoo et al., 2019; Polaski et al., 2019).

Modern Meditation Research

In 1975, a young molecular scientist who practiced yoga and meditation, as taught by Korean Zen master Seung Sung, decided to bring meditation to the hospitals of Worcester, Massachusetts, because "that is where the pain is" (Boyce, 2010, para. 2). Thus Jon Kabat-Zinn created the Mindfulness-Based Stress Reduction (MBSR) Program in 1976 with two intentions (Baer, 2014; Boyce, 2010). The first intention was to test mindfulness-based programs that sought to enhance general health and reduce stress, and the second intention was to develop a program of meditation that could affect health outcomes for pain-related stress, chronic pain, and anxiety (Baer, 2014; Brantley, 2005; Crane et al., 2017). In 1979 the Mindfulness-Based Stress Reduction Program was opened at the University of Massachusetts (Baer, 2014). This step-by-step written protocol of MBSR practice lent itself to scientific evaluation for chronic pain and other chronic diseases (White, 2014). The written protocol makes MBSR easier for researchers to replicate this protocol's effectiveness for physical, mental, and psychological ailments from children to older adults (Reich et al., 2014; White, 2014). The success of the four-year longitudinal study of MBSR for chronic pain influenced the integration of the term "mindfulness" into Western clinical practice (Baer, 2014; Williams et al., 2015).

Contemporary neuroscience research depends on two critical aspects of mindfulness practice: focused attention (Samatha in Pali) and open monitoring (Vipassana in Pali) (Hölzel et al., 2011; Zeidan & Vago, 2016; Zorn et al., 2020). Although meditation is currently being studied for many medical alignments, the root of this practice goes back 25 centuries to the Buddha's teachings, called the Dharma in Sanskrit (Bodhi, 2011). Two Buddhist traditions,

the Mahayana and Theravada (Guillaume et al., 2020; Wallace, 2008), are seen as the base for these newer practices. The compassionate-based meditations are based on Mahayana traditions that rely on karunā (translated as compassion) (Desbordes et al., 2012; Hanh, 2004; Shonin et al., 2015) The mindfulness-based meditations are mostly based on Theravada traditions (Guillaume et al., 2020; Leung et al., 2015; Purser, 2015).

However, B. Alan Wallace (2008), a scholar of Buddhist studies and Sanskrit texts, a former Buddhist monk, and a translator for the Dalai Lama and other high lamas for 14 years, says that the current understanding of mindfulness—that of paying attention without judgment (Crane et al., 2017; Zeidan et al., 2018; Zorn et al., 2020)—is not found in the traditional Buddhists texts. The sacred Sanskrit texts (Abhidharma) or Pali (Abhidhamma) are ancient texts that mean higher doctrine and contain detailed instructions called Buddhist sutras (Bodhi, 2007; Braun, 2016). The word translated as mindfulness *(sati)* is considered to be the gap between sensing the object and owning full awareness of it (Purser, 2015). However, according to the Buddha's instructions, meditation practices were not just to become aware of an object or a thought but included both Samatha (in Pali means tranquility) and Vipassana (in Pali means insight) on retrospective (remembering the past) and perspective (remembering to do things differently in the future) (Bodhi, 2011; Wallace, 2008). Tibetan Buddhist teachings say that meditative practices allow us to develop a skill where we are fully and lovingly aware of our thoughts about the past, but we dare to take different actions full of wisdom and compassion (Stanford, 2013; Wallace, 2008). The gap allows us to develop a mental faculty with which we can evaluate, distinguish, and encourage wholesomeness states, and discourage with compassion the unwholesome states of mind

(Wallace, 2008). According to Buddhist tradition, it is the gap between the breaths where the power of meditation lies, which allows one to experience the silence where everything is (Wallace, 2008). In many ancient cultures, breath is considered a connecting force among all living forms (VanPool & VanPool, 2012). This gap between breaths allows us a decisive moment of pause to consider all aspects of the situation. It gives us an opportunity to act with loving kindness towards all life instead of reacting impulsively (Dalai Lama & Ekman, 2008). According to Viktor Frankl (1985), it is not what is happening to us but our response to our life that makes all the difference.

Similarly, the practice of Positive Psychology teaches us that our lives are constantly changing, and unwanted things occur. By developing meditative practices, acknowledging the present without catastrophizing, and focusing on the positive aspects, we can experience inner happiness in any situation (Compton & Hoffman, 2020; Seligman, 2019). For example, based upon the Buddhist teachings of *Sullatta Sutta* (The Arrow), meditation helps the pain experience via two arrows. One arrow is to fully accept our pain, and the second arrow is to release the pain without evaluating it, thus providing emotional regulation and cognitive control over the experience of pain (Zeidan & Vago, 2016). This approach of encouraging the wholesomeness states of being (Wallace, 2008) allows for completeness.

More recently, neuroscientists studied meditative practices and found that they cause a neuroplastic change in the brain, the "anterior cingulate cortex, insula, temporo-parietal junction, front-limbic network, and default mode network structures" (Hölzel et al., 2011, p. 537). These structural changes help disengage in pain catastrophizing and thus have a lesser experience of pain (Zeidan et al., 2011, 2016, 2018; Zorn et al., 2020). While they did

not use imaging, other MBI practitioners also reported similar reductions in pain experience (Anheyer et al., 2017; Hilton et al., 2017; Kabat-Zinn, 1982; Martinez-Calderon et al., 2019).

The evidence-based popularity of MBSR (Kabat-Zinn, 1982, 2006) helped in the creation of mindfulness-based cognitive therapy (MBCT; Segal et al., 2016) as well as acceptance and commitment therapy (ACT, Hayes, et al., 2016). Although Loving Kindness Meditation has not received vast scientific scrutinies like MBSR, systematic reviews and analysis have concluded that LKM practices are beneficial in treating psychological, emotional, physical, and spiritual problems (Baer, 2014; Carson et al., 2005; Galante et al., 2014; Hilton et al., 2017; Hofmann et al., 2011; Kim et al., 2019; Shonin et al., 2015).

Contemporary Research

Contemporary research evaluates the effectiveness of this practice (MBSR) for chronic pain through functional magnetic resonance imaging (fMRI) (Tang et al., 2015; Veehof et al., 2016; Zorn et al., 2020). Researchers have found that based on the principle of neuroplasticity, meditation changes the neural pathways in the brain (Treadway & Lazar, 2009). One of the first studies to use functional magnetic resonance imaging to see changes in the structures in the brain post-meditation, responsible for the reduction in pain, anxiety, stress, and increase in executive functions was conducted by Lazar et al. (2005) at the Harvard School of Medicine.

In 2005, Lazar et al. studied 20 expert meditators who had practiced meditation for four to six hours a week for nine years and compared them to 15 control meditators who had never meditated or practiced yoga. Under functional magnetic resonance imaging, the meditators' brain regions that are associated with focused attention—prefrontal cortex,

limbic system, and right anterior insula—which are responsible for sensory processing and interception—were thicker in the meditators compared to those of the control population (Lazar et al., 2005). The most significant finding was that older meditators had increased thickness compared to same-age counterparts in the control group (Lazar et al., 2005). This study provided the first data on the structural changes in the brain due to meditation (Lazar et al., 2005). These findings were confirmed by a follow-up study, in which brain signals were observed to increase in the anterior cingulate cortex (ACC) during meditations under fMRIs in nine practiced meditators (Hölzel et al., 2011). In a similar experiment with 16 new meditators who were taught the practice of MBSR for eight weeks, Lazar and colleagues observed an increase in gray matter in brain regions involved in memory, learning, perspective taking, and emotion regulation (Hölzel et al., 2011). The increase in both the ACC and the fronto-insular cortex facilitates cognitive control (Hölzel et al., 2011), which is beneficial for a mental and emotional response to chronic painful stimuli (Gard et al., 2012; Hölzel et al., 2011, 2016; Tang et al., 2007, 2009).

In addition to the anterior cingulate cortex and frontal-singular cortex, recent studies have found meditation affects the limbic system, which includes the hippocampus, the pre-frontal cortex, the brain stem, and the hypothalamic-pituitary-adrenal (HPA) axis, which is responsible for an adaptive response to chronic pain, stress, and high cortisol levels (Gard et al., 2012; Polich et al., 2010; Singleton, 2014; Tang et al., 2007; Timmers et al., 2019; Villafañe et al., 2020).

Persistent chronic pain induces fear of movement, increases stress, and causes cortisol dysfunction (Abdallah & Geha, 2017; Carson et al., 2005; Hannibal et al., 2014; Modarresi et

al., 2021; Timmers et al., 2019). The unpredictable nature of chronic pain can result in fear and develop into a conditioned fear response in the brain over time (Hölzel et al., 2016; McNeil & Rainwater, 1998; Tang et al., 2015). In the western world, pain control primarily focuses on pharmaceutical measures (Bushnell et al., 2015). However, meditation practices target the limbic regions and the orbitofrontal cortex, key regions that reduce and extinguish fear responses and retention of fear memory (Hölzel et al., 2016). The changes in the anterior cingulate cortex and frontal-singular cortex, limbic system, hippocampus, the pre-frontal cortex provide the person a mindful opportunity to: (a) regulate their attention and cognitive control; (b) develop body awareness; (c) alter emotional regulation of stimuli, response to stimuli, reconsolidation, and reappraisal of stimuli; (d) allow a person to self-regulate pain and thus change the perspective of self (Bushnell et al., 2015; Carson et al., 2005; Hölzel et al., 2011; Murphy et al., 1997; Zorn et al., 2020). In this manner, mindful awareness that is cultivated as a result of meditation and allows a person to interrupt their emotional, habitual, practiced response to the pain as an imminent physical threat to a new response that pain is a passing wave of physical sensation, introducing a personal sense of control and well-being (Adler-Neal & Zeidan, 2017; Bushnell et al., 2015; Carson et al., 2005; Polich et al., 2010; Schell et al., 2019; Segal et al., 2016; Tang et al., 2015; Vanhaudenhuyse et al., 2017; Zorn et al., 2020). In addition, even brief periods of meditation were effective in reducing pain and stress in as little as 15 minutes. Brain changes were noticed in four days, one week and four weeks on fMRIs, self-reports, and salivary and serum cortisol levels (Apkarian et al., 2005; Awasthi, 2013; Bottaccioli et al., 2014; Tang et al., 2015; Wu et al., 2019; Zeidan et al., 2011; 2018).

Meditation Research for Nurses

Several studies have found that meditation helps reduce stress among working nurses and student nurses. Ineffective self-care increases nurses' stress levels, which affects their personal lives and their ability to provide quality care, caring relationships, and a healing environment (Budhrani-Shani et al., 2016; Kemper et al., 2011; Sarafis et al., 2016; Wasson et al., 2020). Heightened stress during chronic pain places additional burdens and can lead to burnout and a lack of self-compassion in care providers (Eccleston et al., 2020; Wakim, 2014; Wasson et al., 2020). Additionally, it is known that cortisol increases during stress periods such as CP, which alters hypothalamus-pituitary-adrenal axis activity (Hart et al., 2003; Nelson, 2015). One way to address these stressors and to provide self-care is through meditation, which has demonstrated the ability to reduce stress (Lazar et al., 2005) and increase effective caregiving (Schaafsma et al., 2021; Wakim, 2014). In a study by Mahon et al. (2017), 90 nurses working in university hospitals found that six weeks of meditation reduced stress significantly and increased self-compassion, positively impacting their caregiving abilities. Other meditation studies have demonstrated reduced stress and increased self-care, as reflected in cortisol biomarkers (Nelson, 2015). An additional practice to increase self-care is through loving acts of self-care, which have been demonstrated to decrease stress and increase caring among nurses (Wakim, 2014; Salzberg, 1995; Sarafis et al., 2016). As nursing self-care increases, the biochemical markers of cortisol change, reflecting the extent of that caring-healing outcome (Nelson & Watson, 2012). At St. Joseph's Hospital Medical Center, Nelson (2015) evaluated the reduction in stress following Watson's theory of human caring in 27 nurses. The participants were found to

have a decrease in salivary cortisol (r = -.735, p = .157), increased caring for self feelings (r = -.596, p = .004) and increased treating self with loving kindness (r = -.529, p = .014). The dimensions of caring for self were found to have a statistically significant relationship to cortisol levels, including treating self with loving kindness and accepting one's positive and negative feelings (Nelson, 2015). In similar studies, through self-care and acts of self-compassion and LKM (Shonin et al., 2015), nurses were found to have improved abilities to cope with their stress (Mahon et al., 2017) and chronic pain (Lopes et al., 2019).

Loving Kindness Meditation

As noted and defined earlier, there are several forms of meditation: Vipassana meditation, Mind Programme, Mantra Meditation, Listening to Music, Psychoneuroendocrinoimmunology-based meditation (PNEIMED), MBSR, MBCT, and TM, many of which can be recommended to patients (Innes et al., 2018; Murphy & Lahtinen, 2015; Szekeres & Wertheim, 2015; Travis & Shear, 2010). Some forms of meditation have complicated protocols and require extensive training (Avvenuti et al., 2020; Bansal et al., 2016; Bottaccioli et al., 2014). Most meditation practices have strictly required protocols (Finlay-Jones et al., 2017; Wachholtz et al., 2017), and other forms of meditation, such as Vipassana, TM, PNEIMED, and Sufi, require a consistent formal instruction period followed by observed practice (Avvenuti et al., 2020; Bottaccioli et al., 2014; Gul & Jehangir 2019). Unlike some forms of meditation, Loving Kindness Meditation does not require formal instruction or an observation period. LKM needs a genuine intention to practice loving kindness towards self or others and can be practiced anywhere, both formally and informally throughout the day, and "does not solely focus on sitting still or being silent" (Stanford,

2013; Taylor, 2013, p. 3). It is important to select a practice that is congruent with one's spiritual or religious beliefs for the MBIs to have the desired calming effect (Gul & Jehangir, 2019).

Training is an antecedent for most meditation teaching. Within the literature, some authors noted that their protocol for meditation was to be supervised and monitored for adherence to a particular method (Avvenuti et al., 2020; Bansal et al., 2016). Others noted that initial training was a precursor to the meditation practice. For example, starting Vipassana meditation practice, a 10-day initiation retreat course is required (Marques & Dhiman, 2009). To begin TM practice, a student has to meet in person with a trained instructor and be supervised during meditation instructions for three months—such thorough guidance allows students to receive supervised training from both a novice and a seasoned TM instructor (Avvenuti et al., 2020; Tomljenović et al., 2016). MBSR is the most researched meditation practice; becoming a certified MBSR trainer requires taking a two-year certification course through the University of Massachusetts run by Kabat-Zinn and associates and costs more than $3,000 (William et al., 2015). However, mandatory training ensures that the instructors adhere to the meditation protocols and provide a unified practice representation (Avvenuti et al., 2020; Williams et al., 2015). In contrast, Loving Kindness Meditation requires no instruction or strict protocol, just a willingness to alleviate one's suffering (Hahn, 2015; Stanford, 2013; Taylor, 2012).

Loving kindness is defined as a traditional Buddhist meditation commonly practiced with mindfulness to cultivate an attitude of unconditional love, compassion, and kindness towards oneself and others (Boellinghaus et al., 2014; Carson et al., 2005; Gilbert, 2009,

2010; Salzberg, 1995; Shonin et al., 2015). Several studies define the practice of meditation as a form of loving kindness towards self and others that can bring health and a sense of well-being to the practitioner (Bottaccioli et al., 2014; Finlay-Jones et al., 2017; Lang et al., 2019; Innes et al., 2018; Kim et al., 2019; Murphy & Lahtinen, 2015; Szekeres & Wertheim 2015; Trindade et al., 2020; Wachholtz et al., 2017). In a study with veterans who had suffered trauma and were quick to react in anger, Loving Kindness Meditations allowed them to switch from the framework of vigilance of attack to the framework of vigilance of self-compassion and loving kindness (Lang et al., 2019). In London, six psychiatric patients who practiced LKM and MBCT found they could ease their body tension and experience distress relief (Murphy & Lahtinen, 2015). A systematic review and meta-analysis of 22 RCTs that included over 1,740 participants revealed that the primary outcome for compassion meditations was decreased pain and adverse effects, stress, anxiety, depression, as well as increased quality of life, well-being, anxiety, altruism, mindfulness, compassion, and empathy (Galante et al., 2014). In another systematic review and metanalysis of LKM with 24 research studies with over 1,750 participants, the practice of LKM helped improve positive emotions, improved social connections, and increased positive self-focused emotions (feeling pride, higher self-esteem, being happy) across all studies (Zeng et al., 2015).

Formal and Informal Practice

One of the central ideas of LKM is to fully intend to bring acceptance to mind and body with deep compassion (Carson et al., 2005; Hanh, 2015). This intention can be achieved through formal meditative actions of deep breathing, cognitive vigilance, self-compassion, loving kindness, and forgiveness towards others and self (Finlay-Jones et al., 2017; Gu &

Jehangir, 2019; Kim et al., 2019; Lang et al., 2019; Murphy & Lahtinen, 2015; Szekeres & Wertheim, 2015; Trindade et al., 2020). As improper physical posture during work can cause microtrauma in the body, the intention of LKM can be considered the opposite of microtrauma in the body. Loving Kindness Meditation can be practiced informally throughout the day by performing body scans to achieve the outcomes of letting go of tension, correcting posture, and bringing forth the feeling of gratitude and appreciation for the body in its current state (Carson et al., 2005; Szekeres & Wertheim, 2015; Villafañe, 2020). These small acts of self-compassion are called body scans (Stanford, 2013), Serenity Pause® (Taylor, 2012), and micro-practices of genuine caring (Sitzman & Craven, 2021), and they can be practiced for self or others throughout the day. By practicing micro-skill meditations throughout the day, the participants could prolong and deepen their Loving Kindness Meditation sessions (Stanford, 2013; Szekeres & Wertheim, 2015).

To understand the impact of LKM approaches, one needs to look no further than a study conducted in Iran. This study involved 227 nurses with chronic lower and upper extremity pain and found that meditation was statistically significant ($p < 0.001$) in allowing nurses to cope with their pain (Kheiry et al., 2019). By practicing acts of kindness, self-compassion, and meditation, 37 nurses demonstrated decreased stress and burnout and increased empathy, serenity, and self-compassion (Bazarko et al., 2013). Burnout is caused by repeated stress; however, with the practice of self-compassionate actions, nurses can regain calm and offer competent, compassionate care and professional caring to combat burnout (Gentry, 2002; Johnson, 2012). By practicing self-compassionate acts, nurses can lay down a strong foundation of self-knowing, which is necessary to develop empathy instead of

sympathy, helping them authentically care for others and preventing burnout while increasing professional caring (Boellinghaus et al., 2014; Sitzman & Watson, 2018). The implementation of Loving Kindness Meditation can be practiced formally for 15 minutes daily and throughout the day through self-care micro-actions (Griffin et al., 2021; Sitzman & Craven, 2021).

According to a systematic review and meta-analyses, MBIs were found to be safe and effective for chronic pain and stress, among other physical ailments, and were found to positively impact general well-being (Carson et al., 2005; Irving et al., 2009; Shonin et al., 2015; Van Gordon et al., 2015; Veehof et al., 2016; Zeng et al., 2015). The studies using MBIs with nurses and nursing students found that meditation improved nurses' pain, stress, self-compassion, and general well-being and impacted patient care (Bonamer & Aquino-Russell, 2019; Chang et al., 2016; Lopes et al., 2019; Mahon et al., 2017; Shapiro et al., 2012; Wei et al., 2019).

In a systemic review of 342 papers and 20 studies, loving kindness practices were found to reduce pain and stress and increase empathic accuracy and positive thinking. Moreover, LKM was easier to learn and follow than MBSR, MBCT, or other popular meditation formats. Some researchers in the East are calling Loving Kindness Meditation and compassion meditation practices the second-generation meditations (Irving et al., 2009; Shonin et al., 2015; Van Gordon et al., 2015; Zeng et al., 2015).

Therefore, for its simplicity, ease of use, availability without cost, and the potential to impact nurses' chronic pain, Loving Kindness Meditation was selected as an intervention for this study. During this study, it was hypothesized that through self-compassionate, Loving

Kindness Meditation and actions, nurses would find a complementary pain management tool with the proximal goal of improving chronic pain outcomes and distal goals of improving patient care (Kabat-Zinn & Hanh, 2009; Watson, 2014). To evaluate the change in chronic pain outcomes in the nursing population, this theory-guided intervention used the support of Donabedian's framework (Donabedian, 2005), Positive Psychology (Compton & Hoffman, 2020), Adult Education (Merriam et al., 2007), theory of Self-compassion (Neff, 2003), Watson's theory of Caring Science (Watson, 2011), and theory of Neuroplasticity (Konorski, 1948). These theories provided an underpinning for all the elements in the study and a lens to evaluate the independent and dependent variables (Creswell & Creswell, 2018).

In summary, meditation has several positive impacts on chronic pain patients. The seminal work by Kabat-Zinn was conducted to help patients deal with pain-related stress, chronic pain, and anxiety. Out of the success of the first study in Worcester, Massachusetts, mindfulness-based stress reduction (MBSR) was created. Since then, several different adaptions of MBSR have been used in MBIs for chronic pain. Using modern imaging technology, scientists can observe the regions of the brain that are activated when practicing meditation. The images also show an increase in overall gray matter, increased vascular capacity, and thickening of the prefrontal cortex, right anterior insula, and hippocampus while decreasing activity in the amygdala. These brain changes provide an opportunity for emotional and cognitive control over pain, thus reducing stress, cortisol, and fear of pain due to activities. MBIs were also found to help nurses reduce pain and stress and increase patient care, which is the main objective of this study.

Theoretical Framework

The primary purpose of theory in nursing is to improve practice, encourage reciprocity, and further strengthen the relationship between theory and practice (Fawcett, 2000; Liehr & Smith, 2014; Walker & Avant, 1995). A theory provides a framework for each step, establishes an understanding of how the variables relate to each other, allows purposeful implementation of the research process, and enriches the value of the findings (Fawcett, 2000; McEwen & Wills, 2017). Nursing theory guides and informs the practice and discipline of nursing (Nelson & Watson, 2012). However, most nursing theories were based on other disciplines (McEwen & Wills, 2017). Therefore, the underpinning for this study is provided by Donabedian's model of quality care based on structure, process, and outcome (Donabedian, 1988). The structure for the online pilot study is based on the theories of Positive Psychology (Compton & Hoffman, 2020) and Adult Education (Merriam et al., 2003). The process of the pilot study steps are supported by the theory of Self-compassion (Neff, 2003) and Watson's theory of Human Caring (Watson, 2011). Furthermore, the outcomes of the theory are supported by the theory of Neuroplasticity (Konorski, 1948). The scaffolding of these theories support each element of the INDIRA research.

Donabedian's Theory of Quality Care

The first theoretical support for this study comes from Donabedian's framework of quality healthcare, with the three components being structure, process, and outcome (Donabedian, 1966, 1998). Donabedian stated that an accurate measure of the quality of care is interlinked with the structure, process, and outcome measures, for they provide high-reliability indicators of quality of care (Donabedian, 1988, 2005). The structure includes all

the elements that affect the care being delivered, such as the environment, equipment, human resources, training materials, and delivery methods (Ameh et al., 2017; Zidarov et al., 2016). The process combines all preparations, education materials, and implementation steps (Ross et al., 2016; Tossaint-Schoenmakers et al., 2021). The outcome results from populations that include changes in knowledge, behavior, health status, and health-related quality of life (Ameh et al., 2017; Oostendorp et al., 2020; Zidarov et al., 2016). See Figure 1.1 in Chapter 1 for a visual representation of the INDIRA research process.

A systematic review of 11 research studies based on Donabedian's theory found that three steps are necessary for a successful online electronic education outcome (Tossaint-Schoenmakers et al., 2021). Primarily, the structure represents the organization's (researchers') needs to have the resources and tools (online intervention through REDCap) to provide the intended education to the care recipient (nurse) during their usual daily care. Secondly, the process represents providing information consistently and the participant receiving it and incorporating it into their daily care. Thirdly, the materials or resources disseminated must align and promote the desired outcomes (Tossaint-Schoenmakers et al., 2021). A similar systematic review of 44 studies on the success of electronic health education found that the success depends on the structure of how the innovation of the materials, internal and external motivating factors, and the outcome depends on the planning, engagement, and execution of the implementation (Ross et al., 2016). For clinical interventions, Lilford et al. (2010) stated that costs, sample size, and compliance rates are also a part of the process construct and affect overall outcomes, which inevitably impacts the quality-of-care outcome.

A mark of good quality of care for the patients ultimately depends on the technical knowledge and performance of the caregiver, and interpersonal communications are the "vehicle through which technical care is implemented" (Donabedian, 1988, p. 1744). As the three elements—technical performance, effective communications, and professional caring—are affected in the presence of chronic pain (Budhrani-Shani et al., 2016; Kemper et al., 2011; Sarafis et al., 2016), this study aimed to test the outcome of LKM practices for nurses' chronic pain, which may ultimately impact the distal outcome quality of care for the patients.

The structure portion of this online pilot study was supported by the theories of Positive Psychology (Compton & Hoffman, 2020) and Adult Education to encourage participants' engagement and compliance. The process portion was supported by the theories of Self-compassion (Neff, 2003) and Caring Science (Watson, 2008) to encourage participants to practice self-compassion and take caring actions guided by Caring Science's 10 Caritas Processes®, including the daily practice of LKM. These consistent actions would impact the brain's architecture and neurochemistry through neuroplasticity which the outcomes could measure.

Collectively, theories provide a framework to evaluate the impact of LKM-based micro-practices compared to the active control group (ACG) on the study's outcomes. Positive Psychology and Adult Education theories created the pilot study's structure and were monitored through the pilot study's fidelity and retention rates. The Self-Compassion Scale represents the effects of self-compassion (Neff, 2003). Effects of Caring Science were measured through the Caring Factor Survey–Care Provider (Nelson & Watson, 2012). The theory of neuroplasticity due to the practice of LKM and loving kindness actions were

measured indirectly through the Numeric Pain Rating Scale, Perceived Stress Scale, pulse rate, meditation intake, and serum cortisol levels (Andersson et al., 1999; Bansal et al., 2016; Cleeland & Ryan, 1994; Cohen et al., 1983; Hwu et al., 2000). The effectiveness of this theory was measured through the effects on the study's retention and compliance rates (Tossaint-Schoenmakers et al., 2021). In this manner, Donabedian's framework supported combining theories to provide the rationale for this study's research elements (Creswell & Creswell, 2018).

Positive Psychology

The theory of Positive Psychology supports online interventions. This theory teaches that people can thrive by nourishing their best positive aspects, even in unpleasant circumstances such as chronic pain (Seligman, 1998). The theory of Positive Psychology was created in 1998 by Martin Seligman to understand and encourage the adaptive, creative, emotionally fulfilling, and positive aspects of human behavior (Sheldon & King, 2001). Positive Psychology is the scientific exploration of positive human aspects that function and "flourish at the biological, personal, relational, institutional, cultural, and global dimensions of life" (Seligman & Csikszentmihalyi, 2000). Positive psychology principles encourage one to focus on positive aspects, develop authentic altruism, empathy, compassion, self-compassion, gratitude, and happiness, empower the body and immune system, and create a regular mindfulness practice through meditation (Compton & Hoffman, 2020). These traits can help one establish emotional, social, psychological, and psychological well-being (Compton & Hoffman, 2020). These traits allow a person to seek out and learn proactive coping strategies instead of reactive coping strategies (Schwarzer & Knoll, 2007). As

Positive Psychology actions, these techniques promote well-being; they have been used to help people with chronic illnesses (Hendriks et al., 2020).

Several systematic reviews and meta-analyses have found that positive psychology helps people adjust to their chronic illness, including chronic pain (Bolier et al., 2013; Hendriks et al., 2020; Ong et al., 2020; Slattery et al., 2019). In an online eight-week RCT intervention with 96 participants, it was found that participants in the positive psychology group, compared to the control group, reported significant post-treatment improvement in depression, positive affect, and depression (Müller et al., 2016). A systematic review and meta-analysis of 38 intervention studies in individuals (n = 4,229) experiencing chronic pain found that looking for daily positive aspects, gratitude, happiness, mindfulness, and compassion played a pivotal role in helping lower pain severity in people with noncancerous chronic pain ($r = -0.23$) (Ong et al., 2020). In a similar systematic review and metanalysis of 16 RCTs with (n= 1991) online positive psychology interventions for chronic pain, it was demonstrated that the interventions impacted the quality of pain, reduced pain-related fear, increased mobility, and built psychosocial resources that affected the experience of pain (Braunwalder et al., 2022). A literature review of the role of neuroplasticity and Positive Psychology in mental health clinical practice found that a few positive choices add new brain cells and affect a person's well-being based on the theories of neuroplasticity and neurogenesis (Shaffer, 2012). The practices of Positive Psychology of breathing deeply, monitoring the conscious stream of negative thoughts, practicing gentleness, and mindfulness practices can be critical self-care tools for mental health nurses (Macfarlane & Weber, 2019). The role of Positive Psychology and mindfulness in nursing is not to ignore causes of

extreme distress but to mindfully seek professional assistance for that stressor (Macfarlane & Weber, 2019).

Based on the literature, Positive Psychology (PP) supports the theory of Adult Education, which assumes that people seek information to fill a deficit or find new coping skills (Knowles, 1973; Schwarzer & Knoll, 2007). The use of theories of Self-compassion (Neff, 2003) and Caring Science (Watson, 2008) has become more robust and in congruence with PP, for many researchers believe that compassionate care of self can change one's biology, relationships, and organizations, as well as impact cultural and global dimensions (Neff et al., 2012; Seligman & Csikszentmihalyi, 2000; Watson, 2008).

The Self-compassion theory encourages healthcare workers to care for themselves to provide care to others effectively and advises daily formal meditation practice and informal compassionate self-care throughout the day (Neff, 2003; Neff & Germer, 2013). The Institute of Healthcare Improvement (IHI) has three aims focused on patients: improving the population's health, improving patient care, and reducing costs (Hume, 2018). The fourth aim focuses on providers' well-being, which can be fostered through meaningful recognition, altruism, and self-care actions such as meditation (Hume, 2018). The theory of Caring Science allows nurses to connect with their original purpose of nursing through consistent, loving, kind actions. These actions include Loving Kindness Meditation and human micro-activities such as pausing, breathing, and radiating compassion to enhance one's caring healing consciousness (Evangelista et al., 2020; Nelson et al., 2012; Pajnkihar et al., 2017; Raines et al., 2012). It is known that consistently focusing on positive strengths, positive thinking, gratitude, meditation, breathing, good body posture, and regular meditation changes

the neurology of the brain based on the theory of neurogenesis and impacts mental processes and biochemistry, reduces stress and chronic pain intensity, and increases physical functions (Braunwalder et al., 2022; Hendriks et al.,. 2019; Macfarlane & Weber, 2019; Ong et al., 2020; Seligman & Csikszentmihalyi, 2000; Shaffer, 2012). With balanced health and well-being, nurses can bring their full presence to their patients and provide caring environments that can allow healing, impacting individual patients, their families, and communities, leading to nursing satisfaction and retention (Parcells & Nelson, 2012) and increased patient satisfaction, which benefits organizations (Pajnkihar et al., 2017; Watson, 2006). A healthy population within working healthcare systems can impact global wellness and heighten individual and global consciousness of human potential (Parcells & Nelson, 2012).

The use of the theory of Neuroplasticity is encouraged by Seligman (2019), who supports engagement in scientific exploration to understand the role of PP and PP actions, such as meditation, on neuroplasticity (Compton & Hoffman, 2020; Shaffer, 2012). The compassionate, loving practices suggested by these theories (Braunwalder et al., 2022) were used as an intervention for chronic pain in this research. In this manner, the theory of PP supports using the theories of Adult Education, Self-compassion, Caring Science, and Neuroplasticity for consistent positive choices can ultimately lead to building "thriving individuals, families, and communities" (Seligman & Csikszentmihalyi, 2000, p. 13).

Adult Education

The structure of the study includes online intervention supported by the theory of Adult Education known as andragogy, which is any form of adult learning (Merriam et al.,

2007). The theory of Adult Education was created by Malcolm Knowles based on four main assumptions:

1. Adult students are self-directed and prefer to be engaged in the process of learning.

2. They come with a rich background but believe in their own life experiences; therefore, providing active participation and showing that experiential learning should be at the core of training adults.

3. Adults seek learning opportunities due to a need in their life; those needs should serve as guideposts for training activities.

4. Adults prefer to learn skills they can utilize immediately; therefore, practical applications are more appropriate than theoretical information (Knowles, 1973; Merriam et al., 2007).

Andragogy is a foundational principle for high-quality online education programs for nurses who are self-directed learners and enjoy the flexibility of online programs (DeCelle, 2016). Nurses who are engrained to care for others but often lack self-care tools can use the principles of andragogy, which can guide nurses to practice self-care tools (Blum, 2014).

Although no online intervention studies with chronic pain patients using the theory of Adult Education were found, nursing education uses Knowles theory successfully. Knowles theory supports usable online learning modalities, adherence to practice, increased retention, motivation, and achievement of desired patient care outcomes while providing learners satisfaction with program delivery education (Edlund, 2014). In a systematic review of seven studies comparing online teachings to in-person education, Sinclair et al. (2017) found that professional outcomes were equal for both modes of instruction. Schroeder et al. (2016)

conducted an online teaching project in an orthopedic unit with registered nurses (n = 30) on the linkage between pain management and patient satisfaction outcomes. Within three months of the online educational intervention, a significant increase was found in nurses' knowledge, and patient satisfaction scores increased (Schroeder et al., 2016). The nurses reported that online learning allowed them the flexibility to control where and when to complete the educational program (Schroeder et al., 2016). In a similar study with a 15-week training and 296 healthcare providers in Ontario, Canada, the theory of Adult Learning effectively transmitted knowledge about chronic pain and prescription dispersion. The providers developed self-efficacy and understanding ($p < 0.0001$), which impacted the quality and safety of their patients with chronic pain. The participation rates grew, and the satisfaction rating of the healthcare providers was 96%, for they were provided "new teaching and learning" that was "applied at the right time and the right place" and proved to be effective (Furlan et al., 2019).

Similarly, a systematic review of 10 studies that provided digitally based, asynchronized education on dementia training for healthcare providers found that nurses were the most common participants in the studies (Scerbe et al., 2019). Many studies supplemented their online modules with materials that were available offline, such as printed materials, audio files, text entries, graphics, and email reminders. The review found that in all studies, participants reported an increase in self-efficacy, readiness to change, improved communication and dementia knowledge, and they enjoyed the flexibility of learning about their specific needs remotely (Scerbe et al., 2019).

Based on the literature review, the online pilot study was constructed with the principle of Adult Education in mind. The participants' life experiences with chronic pain provided evidence that chronic pain affects their lives. They were internally motivated to seek relief and ready to learn an evidence-based therapy for pain management (Knowles, 1973; Merriam et al., 2007). This online approach to the pilot study also provided control to self-directed learners by giving them the flexibility to listen to LKM meditation online or download it to their devices, print the instruction sheets, and carry it with them to prolong their meditative experience (Scerbe et al., 2019; Szekeres & Wertheim, 2015). In this manner, the Adult Education theory supported the online pilot study.

Self-compassion

The fifth provision of the American Nurses Association's Code of Ethics states that nurses should extend the same duties of care for self as we do for our patients, which includes promoting personal health safety and well-being, integrity, perseverance, and the wholeness of character, maintaining competence, and pursuit of personal and professional growth (American Nurses Association, 2015). The nine provisions of the American Nurses Association's Code of Ethics are shown in Table 2.1.

Despite this provision, self-care is not often taught in nursing education (Blum, 2014). One reason for not including self-care is that nursing programs tailor their curriculum to achieve the highest pass rates based on National Council Licensure Examination for Registered Nurses (NCLEX- RN©) test plans (Brown, 2003). The current test plan from the National Council Licensure Examination for Registered Nurses (NCLEX- RN©) includes management of care (20%), safety and infection control (12%), health promotion and

maintenance (9%), psychological integrity (9%), primary care and comfort (9%), pharmacological and parenteral therapies (15%), reduction risk potential (12%), and physiological adaptation (14%). The test plan breakdown is shown in Figure 2.1.

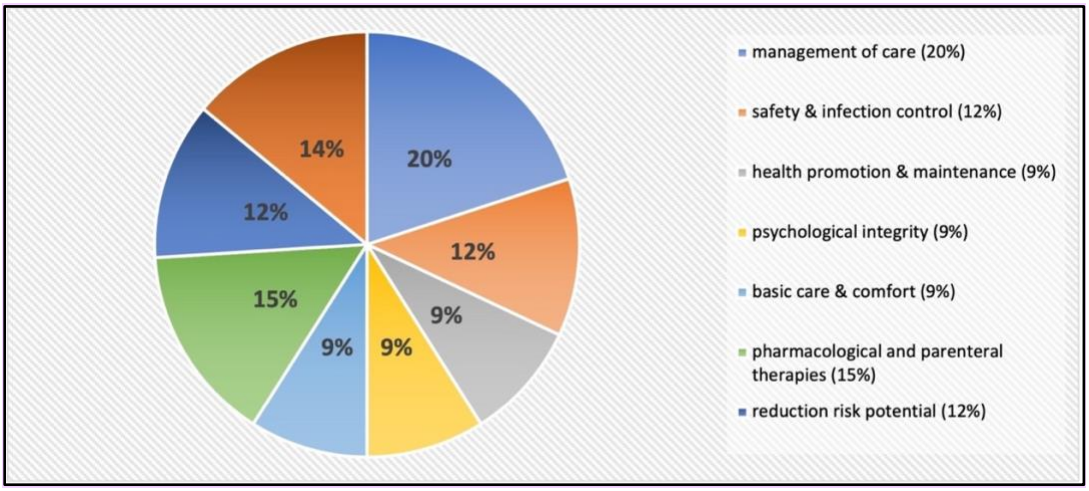
Table 2.1

Nine American Nurses Association's Code of Ethics Provisions

Code	Provisions
Provision 1	The nurse practices with compassion and respect for the inherent dignity, worth, and unique attributes of every person.
Provision 2	The nurse's primary commitment is to the patient, whether an individual, family, group, community, or population.
Provision 3	The nurse promotes, advocates for, and protects the rights, health, and safety of the patient.
Provision 4	The nurse has authority, accountability, and responsibility for nursing practice; makes decisions; and takes action consistent with the obligation to provide optimal patient care.
Provision 5	The nurse owes the same duties to self as to others, including the responsibility to promote health and safety, preserve wholeness of character and integrity, maintain competence, and continue personal and professional growth.
Provision 6	The nurse, through individual and collective effort, establishes, maintains, and improves the ethical environment of the work setting and conditions of employment that are conducive to safe, quality healthcare.
Provision 7	The nurse, in all roles and settings, advances the profession through research and scholarly inquiry, professional standards development, and the generation of both nursing and health policy.
Provision 8	The nurse collaborates with other health professionals and the public to protect human rights, promote health diplomacy, and reduce health disparities.
Provision 9	The profession of nursing, collectively through its professional organizations, must articulate nursing values, maintain the integrity of the profession, and integrate principles of social justice into nursing and health policy.

Figure 2.1

Test Plan Information Provided by NCSBN®



Note. This graph is based on test plan information provided by The National Council of State Boards of Nursing (NCSBN®) (Hensel & Billings, 2020).

Although a section of NCLEX-RN evaluates teaching self-care to patients and their primary caregivers, little importance is given to teaching nursing students to care for themselves (Green, 2019; Nevins & Sherman, 2015). An American College Health Association's (ACHA) survey found that college students find their learning experiences "traumatic or difficult to handle" (ACHA, 2014, p. 14). Without training to handle stress, nursing students often find themselves overwhelmed (Green, 2019) by high-stress levels (Oner & Ustun, 2013). Yet, robust research shows that self-care practices can reduce nursing stress, compassion fatigue, and burnout (Nevins et al., 2019). Self-compassion is a form of self-care for healthcare workers and students who are personally affected by the care they provide to their patients (Neff et al., 2020).

Self-compassion Theory

The theory of self-compassion was created by Dr. Neff in 2003 and had three components: self-kindness vs. self-judgment, common humanity vs. isolation, and mindfulness vs. overidentification (Neff, 2013). Self-kindness encourages one to recognize that we all are imperfect and make mistakes lovingly and to be kind to oneself in thoughts, words, and actions (Neff, 2003). The theory encourages people not to ignore their pain but to hold their pain in kindness and understanding (Costa & Pinto-Gouveia, 2011). Emotionally reacting to pain with self-compassion and acceptance can lessen pain intensity, fatigue, and depression and improve coping (Carvalho et al., 2018; Friis et al., 2015). The practice of self-compassion equips the individual to provide better care and avoid compassion fatigue and burnout (Neff, 2003; Neff et al., 2020; Rudaz et al., 2017). Common humanity versus isolation teaches us that we do not have the human experience alone; we all experience common themes at one time or another (Neff, 2003). Using this theory, one is encouraged to see ourselves as a part of the whole rather than holding ourselves apart or viewing our experiences as unique and uncommon (Neff, 2003, 2011). According to Neff (2003, 2020) and Neff and Germer (2017), the consistent practice of mindfulness teaches us to be mindful of our painful experiences and not ignore or deny their presence. Such mindfulness can be practiced either formally during meditation or informally by monitoring actions and internal dialogues, turning them into caring, self-soothing, and encouraging words instead of self-critical ones (Kearney et al., 2013; Neff, 2011). Since the introduction of Neff's theory in the field of educational psychology, it has been used in a large body of research with numerous

studies on topics of education, psychology, and healthcare (Biber & Ellis, 2017; Carvalho et al., 2020; Conversano et al., 2020; Raab, 2014; Sinclair et al., 2017).

A systematic review of 200 studies with healthcare workers since 2003 that used Neff's theory found a consistent link between increased self-compassion, forgiveness, concern, and altruism and decreased anxiety, depression, and stress (Raab, 2014). Moreover, the analysis revealed that mindfulness practices played a significant role in helping nurses develop and depend on self-compassion (Raab, 2014). Contrary to Raab's (2014) findings, a meta-analysis of 69 studies with healthcare works by Sinclair et al. (2017) concluded that although the staff self-reported improvements in self-care, self-awareness, and health, no studies included data on improved patient care. However, a later systematic review of 58 studies confirmed Raab's (2014) findings and found that compassion-based interventions explicitly delivered for healthcare workers improved and maintained increased levels of self-compassion and impacted anxiety, stress, burnout, and depression (Conversano et al., 2020). The findings also concluded that self-compassion encouraged the practice of mindfulness, which enhanced self-compassion and positively affected healthcare providers' well-being, creating positive working environments, professional satisfaction, and patient care (Conversano et al., 2020). However, throughout the in-text citations, one out of 58 studies showed improvement in inpatient care (Conversano et al., 2020).

Some studies have shown that practicing mindfulness has self-regulating effects on chronic pain outcomes (Beaulac & Bailly, 2015; Carson et al., 2005; Crisp et al., 2016; Fox et al., 2014; Tang et al., 2015: Zeidan et al., 2011). A 12-month study of 89 Portuguese women with chronic musculoskeletal pain (Carvalho et al., 2020) found that the root of

motivation to perform self-care action was positively correlated to self-compassion, and both self-compassion and mindfulness were negatively correlated to depression (Carvalho et al., 2020). In a one-year, longitudinal study with 86 women, self-compassion was found to be a significant predictor of depressive symptoms, which impacted functional impairment and depression (Carvalho et al., 2018). The theory of Self-compassion is congruent with the theory of Positive Psychology, which states that being kind to oneself is a better predictor of self-management and behavioral change (Braunwalder et al., 2022; Galante et al., 2014; Hendriks et al., 2020; Neff, 2003). In this manner, the theory of self-compassion supported the formal and informal practice of micro-actions for the INDIRA study, the effects of which were collected through the Self-Compassion Scale Short Form (SCS-SF) (Neff, 2003, 2018b).

Caring Science

The Theory of Human Caring was developed between 1975 and 1979 to add "language order, structure, and clarity of concepts and worldview underlying nursing as a distinct discipline and profession" (Watson & Woodward, 2010, p. 322). Dr. Jean Watson said that the word theory "literally means to see" (Watson, 2011, p. 1). In the 1980s, along with her colleagues, she created the Center for Human Caring at the University of Colorado to study caring science in administration and clinical practice (Sakalys & Watson, 1986). During her time there, Dr. Watson devoted her time to developing and exploring the science of caring—the theoretical, moral foundation of nursing that leads to a transformation of self and practice (Foss-Durant et al., 2015; Watson, 2005, 2008). According to Dr. Watson, caring is an ethical, dynamic choice that occurs in the present moment where the past, future,

and present are happening all at once, creating a transpersonal moment between the nurse and her patient that has the potential to manifest healing/harmony in the soul/spirit, mind, and body (Nelson et al., 2012; Watson, 1988, 2005, 2008). The term transpersonal refers to "values of deep connectedness, relationship, subjective meaning, and shared humanity" (Watson, 2002, p. 13). We can transform ourselves and our operating systems by cultivating the Caritas consciousness and creating transpersonal moments (Watson, 2008). The theory of human caring, now called Caring Science, is easily understood by all cultures and has garnered worldwide acceptance (Rexroth & Davidhizar, 2003). For this groundbreaking effort to bring caring back to the nursing profession, Dr. Watson has been recognized globally for the impact of her work with 14 honorary doctoral degrees, including 11 international honorary degrees (Sitzman & Watson, 2018).

Caritas Processes®

The theory of human caring is based on humanistic and spiritual value systems, which help differentiate this nursing theory from other nursing theories focused solely on performing mechanistic tasks (DiNapoli et al., 2010). The Caritas Processes allow nurses to create a dominant caring healing consciousness that can transcend time and physical boundaries (Watson, 2006). This dominant intention of caring can create healing moments that help the patient potentially "access the healer within" (Watson, 2006, p. 52). In 1979 Dr. Watson developed ten caring factors to guide the core of nursing practice and professionals (DiNapoli et al., 2010). Dr. Watson stated that the original ten carative factors were a counterpoint to a dominant curative culture in the medical profession, without caring nursing professionals functioning as skilled technical workers (Watson, 2006).

Further development of the carative factors found them to be expanded to include ethics, art, metaphysics-spiritual, philosophical, and transpersonal aspects of caring moments as the core framework for the theory of human caring (Watson, 2006). The carative factors are now called Caritas Processes, emphasizing a deeper connection between love, caring, and the human living experience (Watson, 2006), including love for all humanity (Nelson et al., 2011). The word Caritas is derived from Latin, meaning to appreciate, cherish, and provide loving attention with compassion and charity (Sitzman & Watson, 2018). Continued development of the Caritas Processes focused on the unity of the mind-body-spirit connection in the caring paradigm (Watson, 2006). With continued growth, the theory of human caring and Caritas Processes were intertwined with Master Thích Nhất Hạnh's mindfulness practices (Sitzman & Watson, 2018). This scaffolding of two similar philosophies gives nurses mindfulness tools to understand, internalize, and meaningfully translate caring into their daily life (Sitzman & Watson, 2018). Then nurses can authentically practice the art of caring for themselves and others "from within and without" (Sitzman & Watson, 2015, p. 6). The 10 Caritas Processes are emphasized as universal truths (Sitzman & 2015). Daily micro-practices can achieve daily inner balance and harmony through Caritas Processes, for "human caring is delicate and fragile; it has to be honored, named, and cultivated to be sustained" (Watson, 2012b). The 10 Caritas Processes allow for creating a transpersonal-caring healing environment that can have a holographic healing effect between nurses, patients, families, and organizations (Sitzman & Watson, 2018). The Caritas Processes are provided in Table 2.2 in layperson's terms for easier understanding (Nelson & Watson, 2011, p. 8).

Table 2.2

Caritas Processes

Caritas Process	Actions
#1	Cultivate a practice of loving kindness, compassion, and forgiveness for self/others *Loving Kindness Meditation*
#2	Be authentically present and cultivate faith/hope *Loving Kindness Meditation*
#3	Cultivate and support one's spiritual practices *Loving Kindness Meditation*
#4	Create and sustain loving, trusting, caring relationships *Serenity Pause, Three Breath Meditation, Supportive Touch*
#5	Promote expression of positive and negative feelings *Serenity Pause, Three Breath Meditation, Supportive Touch*
#6	Creative problem-solve *Serenity Pause, Three Breath Meditation, Supportive Touch*
#7	Engage in effective teaching and learning to expand health/wellness *Full presence, creating transpersonal caring moments*
#8	Create a healing environment at all levels *Full presence, creating transpersonal caring moments*
#9	Practice sacred acts of tending to our/patients basic needs *Loving Kindness Meditation, Supportive Touch*
#10	Allow belief in spiritual or miracles *Loving Kindness Meditation, Full presence, creating transpersonal caring moments*

These Caritas Processes of Watson's Caring Science (WCS) framework include the priceless commodities of loving kindness and unity, developing authentic presence, embodying a caring-healing environment, and openness to miracles or unexpected and inexplicable events (Watson, 2005, 2008). Such caring for humanity can create healing environments and impact patients, as demonstrated in the following examples (Parcells &

Nelson, 2012). In a single-blind RCT, Ozan and Okumus (2017) demonstrated that nurses trained in the Caring Science framework were able to help 86 women in an in-vitro (IVF) fertilization clinic develop coping skills through forgiveness, trust, unconditional love, and being open to miracles, which reduced their mean anxiety score by 13 points and distress by 14 points.

The Watson's Caring Science framework has been used in 300 magnet hospitals in the U.S. and globally (Nelson & Watson, 2011). Moreover, the effectiveness of this theory has been confirmed by many systematic reviews (Carvalho et al., 2011; Drake, 2016; Favero et al., 2009; Romero-Martín et al., 2019; Smith, 2004; Wei & Watson, 2019; Wei et al., 2019; Wolf, 2012). Carvalho et al. (2011) evaluated five studies based on the Caring Science theory and found that most research was conducted in the academic field. In their conclusion, Carvalho et al. (2011) stated that using the Caritas Processes, which can improve nurses' quality of care for patients and impact their community, is still little used by nurses in clinical practice. Drake's (2016) systematic analysis of caring based on the Caring Science theory found that caring correlated with patients' perception of nurses' caring. Caritas Processes were conveyed as loving care, attention, communication, safety, and touch. Such caring moments were noted by Favero et al. (2009), who stated that although the definitions of Caritas Processes have changed, their practice, partly or wholly, can affect the interactions as nurses begin to see their clients as unique beings, thus creating a transformative experience for the human experience and nursing practice. In a similar analysis, Smith (2004) found that caring science significantly impacted nursing practice, and the international notes appeal to this pioneering work.

In the most recent systematic review, Wei et al. (2019) found that using the WCS framework decreased patients' emotional strain, increased confidence and self-management, improved nursing students' confidence, increased student nurses' awareness of professional, caring behaviors, and improved their emotional well-being. Professional caring is defined as intentionally providing "technical, emotional, mental, aesthetic, humanistic, ethical and technically" complex care (Watson, 2011, p. 78), as well as progress in self-development (Halldorsdottir, 1996). The theory of WCS informs a nurse's capacity of caring, commitment to take acts of caring, create conditions that support the caring practices, take consistent, caring actions, and results in positive consequences for both the nurse and the patient. As caring is at the center of the WCS framework, an authentic caring presence has the consequence of flourishing and uplifting the quality of care for both the nurse and the patients (Watson, 1988, p. 115).

The WCS theory can benefit institutional financial interests, the nurses' well-being, and patient care outcomes (Watson, 2006). Through simple acts of loving kindness, nurses can impact the vibrational healing environment, leading to improved patient satisfaction and nurse retention, and also profoundly impact the personal and collective ability to achieve full human potential (Parcells & Nelson, 2012). For WCS, the concept of intentional caring provides an authentic caring model that is different from the current customer care model and can sustain a caring-healing relationship between both practitioners and clients, impacting the healthcare systems and communities as well as having a global impact (Pajnkihar et al., 2017; Watson, 2011; Wei & Watson, 2019). The WCS framework demonstrates the potential to play a pivotal role in transforming the current interdisciplinary healthcare system through

the conscious, caring actions of the practitioners (Watson, 2009; Wei & Watson, 2019). Based on this literature review, WCS supports Loving Kindness Meditation as it develops unconditional love and mindfulness and uses micro-actions to stay in the present moment as part of the Caritas Processes. The effectiveness of WCS was measured through Caring Factor Survey–Care Provider Version (CFS-CPV). While the use of WCS addressed the caring and self-care of the nurse, the opportunity to use the framework of neuroplasticity to manage the impact of consistent meditative and compassionate micro action for CP on the nurse strengthened this study.

Neuroplasticity

In response to actual or anticipated pain, stress can overwhelm the behavioral, autonomic sympathetic adrenal medullary, and neuroendocrine systems (Radley et al., 2015; Takahashi et al., 2005; Timmers et al., 2019). Due to neuroplasticity and the ability to model and remodel neurologic patterns, extended and repeated chronic pain and chronic stress conditions change the brain and affect the brain and the body chemistry (Abdallah & Geha, 2017; Garland et al., 2015; McEwen, 2017; Timmers et al., 2019). Jerzy Konorski was the first scientist to propose the theory of neuroplasticity, based on Pavlov's experiments, in 1948 (Bijoch et al., 2020; Bromiley, 1949; Demarin & Morovic, 2014). According to Konorski, neuroplasticity occurs due to repeated stimuli or practice of a skill and entails not just growing new neurons but also remodeling the existing network of neurons (Bromiley, 1949). Konorski hypothesized that through repeated stimuli or practice, the brain creates new synaptic connections or prunes those synaptic connections when the stimuli/actions are inhibited (Bromiley, 1949). Konorski defined neuroplasticity as the brain's ability to adapt,

remodel, and reorganize under repeated practice or conditions (Bijoch et al., 2020; Bromiley, 1949; Demarin & Morovic, 2014).

Based on the theory of neuroplasticity, contemporary scientists are analyzing if the effects of stress and chronic pain, which are known to change the architecture and neurobiology of the brain, can be reversed through mental training of meditative practices (Hölzel et al., 2011; Radley et al., 2015; Tang et al., 2015; Zeidan et al., 2011, 2012; Zorn et al., 2020). Scientists can now capture neurons that fire many times per millisecond through functional Magnetic Resonance Imaging (Treadway & Lazar, 2009). In the last 25 years, such neuroimaging has offered the opportunity to study such changes using 3-D images with "extremely high clarity and spatial resolution" (Treadway & Lazar, 2009, p. 187), allowing neuropsychologists to see the precise location of changes within the brain during and due to meditation practices (Lazar et al., 2005; Lomas et al., 2015; Tang et al., 2015). Recent studies using fMRIs have confirmed Konorski's theory that the brain does have the capacity to change its network as a result of repeated focus, such as engaging in cognitive functions during meditation (Arch et al., 2016; Engström & Söderfeldt, 2010; Hasenkamp & Barsalou, 2012; Lazar et al., 2005; Mathur et al., 2016; Zeidan et al., 2012; Zorn et al., 2020).

Researchers have also found that meditative practices lead to an increase in overall gray matter volume, vascular capacity, an increase in the prefrontal cortex, right anterior insula, and hippocampus, and decreased activity in the amygdala (Lazar et al., 2000, 2005; Hölzel et al., 2011; Zeidan et al., 2011, 2012, 2018, 2019; Zorn et al., 2020). These regions provide focus and control of cognitive and emotional processing during the pain and stress experiences leading to pain uncoupling (Bijoch et al., 2020; Bushnell et al., 2015; Conrad,

2008; Hölzel et al., 2011; Mathur et al., 2016; Ploghaus et al., 1999; Zorn et al., 2020). Pain uncoupling is defined as cognitive mechanisms that help downregulate the sensory experience of pain from an imminent anticipated threat to a passing wave of physical sensation, which results in lowered pain catastrophizing (Tang et al., 2015; Veehof et al., 2016; Zeidan et al., 2011, 2016, 2019; Zorn et al., 2020). Pain catastrophizing is a negative mental state that exaggerates the anticipated or actual pain experience (Sullivan et al., 2006). Due to structural changes in the gray matter—prefrontal cortex, right anterior insula, hippocampus, and amygdala—even new meditators can become aware of their thought processes and take the opportunity to interrupt their habitual ways of reacting to pain experiences (pain uncoupling), resulting in better pain management and changes in gray matter (Carson et al., 2005; Hölzel et al., 2011; Segal et al., 2016; Tang et al., 2015; Zeidan et al., 2016; Zorn et al., 2020). The research in neuroplasticity demonstrates that pain and meditation alter brain structures, impacting one's subjective experiences (Hölzel et al., 2011; Tang et al., 2010, 2012, 2015; Zeidan, 2010, 2011). If the original cause of chronic pain is untreated, it changes the structure within the brain, nervous system, and physiology and evolves beyond the original cause to become a different condition of its own (Fine, 2011; Zeidan et al., 2011). However, based on the theory of neuroplasticity and the use of fMRI, several studies have found that the brief or longitudinal practice of meditation has a positive effect on pain and stress (Tang et al., 2010, 2012, 2015; Zeidan, 2010, 2011, 2016; Zorn et al., 2020).

For example, Zeidan et al. (2011) found that a Shamatha, or focused attention meditation intervention, found changes in brain regions within four days of practice, allowing

the subjects better control of their pain experience. An RCT of 45 participants demonstrated that with as little as 11 hours of practice over 30 days with integrated mind-body training involving body relaxation, mindfulness training, calming music, and mental imagery, there was an increase in gray matter and white matter changes in the anterior cingulate (Tang et al., 2010). Brief 3-day 20-minute MBIs were found to be as effective as 15-minute meditations done for thirty days in lowering heart rate, blood pressure, and pain measurements (Zeidan et al., 2011). In the systematic analysis of 22 research studies, Loving Kindness Meditation of five to 15 minutes of practice, with interventions lasting for two to four weeks, was demonstrated to be effective in reducing suffering and increasing well-being (Galante et al., 2014). A 15-minute, three-week intervention for people with a limited amount of money and time was effective in helping 42 healthy individuals develop mood and emotional regulation, which was responsible for decreased cortisol production in response to daily stressors (Wu et al., 2019). Interventions with shorter duration had low attrition rates compared to attrition rates among healthcare workers who practiced MBIs that lasted longer than eight weeks (Galante et al., 2014; Seppala et al., 2014).

Additionally, in a study of 37 new meditators and 27 expert meditators, it was found that pain unpleasantness in both groups was reduced, and pain reduction was correlated to cognitive attitude cultivated by mindfulness meditation (Zorn et al., 2020). A meta-analysis of nine RCTs found that meditators had greater left inferior temporal gyrus volume, which is responsible for greater focus and control of subjective experiences (Clausen et al., 2014). A systematic review of nine RCTs with 139 chronic pain patients versus 148 healthy patients found significant positive changes in the increased activation of the dorsolateral prefrontal

cortex (dlPFC), prefrontal cortex (PFC), orbitofrontal cortex (OBF), somatosensory cortices (SSC), and limbic system in chronic pain patients after MBIs that included transcendental meditation technique (n = 1), cognitive-behavioral therapy (n = 4), and mindfulness meditation (n = 4) (Nascimento et al., 2018). The review of studies based on neuroplasticity in the brain after meditation found that meditation reduced pain, stress, heartbeat, and cortisol levels, promoted mental and physical health, and improved cognitive performance (Tang et al., 2015). Based on this literature review, the theory of neuroplasticity supported the INDIRA study's aim to impact pain, stress, pulse rate, cortisol levels, and professional caring through an intervention of loving kindness-based micro-practices. The outcomes of pain, stress, cortisol, pulse rate, and professional caring were measured to assess the impact of the interventions. Therefore, studies examining the effects of meditation use on caregivers, more specifically nurses, can have positive implications for clinical settings.

In conclusion, Donabedian's construct of structure supports online intervention, which is supported by the theories of Positive Psychology and Adult Education. Positive Psychology theory endorses the intervention of nurses' self-help-seeking measures to thrive within their chronic pain experience by taking consistent positive mental and physical actions (Seligman, 1998). This framework and the theory of Adult Education supported the online intervention, providing the nurse control over practicing the meditation-based micro-practices at a place and time of their choosing (Merriam et al., 2007). The construct of Donabedian's outcome for Positive Psychology and Adult Theory were measured through retention and compliance rates (Tossaint-Schoenmakers et al., 2021). The outcome for self-compassion is represented by the Self-Compassion Scale. Effects of Caring Science were

measured through the Caring Factor Survey–Care Provider (Nelson & Watson, 2012). The Theory of Neuroplasticity was measured via the Numeric Pain Rating Scale, Perceived Stress Scale, pulse rate, meditation intake, and serum cortisol levels (Andersson et al., 1999; Bansal et al., 2016; Cleeland & Ryan, 1994; Cohen et al., 1983; Hwu et al., 2000).

Conclusion

According to the Centers for Disease Control and Prevention (Zelaya et al., 2020), over 20% of United States adults experience CP, costing approximately $1.1 trillion annually. The intangible costs of the effects of CP, especially for nurses, are unknown. The main factors contributing to chronic pain are gender, age, ethnicity, surgical interventions, socioeconomic status, and genetic factors. Another factor contributing to pain is that patients from minority and lower socioeconomic backgrounds can not afford the services to address CP, do not have access to these services, or are not comfortable accessing healthcare services based on previous experiences due to bias. Nevertheless, the COVID-19 pandemic disrupted CP management services for all patients.

During the COVID-19 pandemic, nurses faced unprecedented mental, emotional, and physical stress. The acknowledged or unacknowledged professional stress experienced by nurses can be measured in cortisol levels long after the stressful event is over. Currently, nurses are not trained to handle stress through self-care management, as these skills are not provided in the nursing curriculum because they are not asked about on NCLEX exams. Therefore, during regular nursing practice, chronic pain and professional and personal stress can cause distress, hypertension, apathy, and substance abuse, leading to nursing burnout and, in some cases, suicide. Burnout results in high turnover rates, exacerbating the existing

shortage of nurses. The fourth aim of The Institute of Healthcare Improvement (IHI) is to foster providers' well-being to fulfill the first three aims of improving the experience, providing healthcare, and reducing costs (Gilbert et al., 2020). The fourth aim of provider well-being through self-care actions can be accomplished through meditative practices. Recent research has demonstrated that meditation practices for short periods can impact chronic pain and reduce stress, which are two sides of the same coin.

There are various meditation practices, from Vipassana meditation to meditation-based stress reduction (MBSR). In the last 25 years, neuroimaging has offered the opportunity to study brain changes before, during, and after meditation practices using high-resolution 3-D images. These studies demonstrated that due to structural changes in the gray matter—prefrontal cortex, right anterior insula, hippocampus, and amygdala—even new meditators could take the opportunity to interrupt their habitual ways of responding to pain, resulting in better pain management. Although many current studies are based on MBSR, we used Loving Kindness Meditation (LKM) as it is freely available, and easy to understand and practice.

Based on principles of adult learning theory, the intervention group in this study were encouraged to practice their LKM-based micro-practices at a place and time of their choosing. Daily compassionate self-care actions are supported by the theories of Positive Psychology, Self-compassion, and Watson's Caring Science. Based on the theory of neuroplasticity, these consistent practices can cause positive changes in the brain that can help with pain management. The results of pain management were measured through proximal outcomes of reduced chronic pain, stress, cortisol levels, pulse rate, analgesic

intake, and increased self-compassion and professional caring. The distal goals of this study are patient satisfaction and nurse retention.

CHAPTER 3

METHODOLOGY

Chapter 3 familiarizes the reader with the purpose of the study and the research questions. The research design was structured as a pilot study of a randomized control trial design, and sample characteristics, sampling procedure, setting, and sample size are presented. Reliable and valid tools were used to measure and assess outcomes. Psychometrics and examples of participant completion are provided. The conclusion of the chapter focuses on data collection, analysis, and storage plan.

Purpose

This randomized control pilot trial aimed to assess the feasibility and acceptability of conducting the INDIRA study. INDIRA is an acronym created by an acronym generator for a three-week, online, randomized controlled trial to determine the impact of a meditation-based intervention, compared to an attention-controlled group, on nurses' chronic pain (CP) outcomes of pain, stress, self-compassion, professional caring, pulse rate, analgesic intake, and cortisol. The INDIRA study fills a gap in the literature lacking interventions to manage chronic pain among nurses.

Research Design

Although a randomized controlled trial (RCT) design is considered the gold standard as it yields the highest level of evidence (Level I), the drawbacks of RCT are its complex design and statistical analysis (Rajagopalan et al., 2013). A pilot feasibility plan provides "the greatest efficacy" (Bowen et al., 2009, p. 2), whether such full-scale definitive RCT is feasible (Arain et al., 2010; Polit & Beck, 2020). A pilot study collects information as to

whether the larger RCT can be conducted, while a pilot trial includes all the components of the larger trial, including randomization (Arian et al., 2010). According to Polit and Beck (2020), "all pilot studies are feasibility studies" (p. 633). A pilot trial is a smaller form of the more significant proposed RCT and is conducted to confirm the seamless flow of the proposed intervention, procedures, recruitment, randomization, and assessments (Arian et al., 2010). Thus, a pilot trial design was used to help refine the more extensive proposed study and test the "entire set of procedures" (Polit & Beck, 2020, p. 633). The following questions were used to confirm the feasibility and enable researchers to avoid costly errors and unnecessary wasted time and money (Arain et al., 2010; Bowen et al., 2009; Orsmond & Cohn, 2015).

a) Was there a demand for this study, as indicated by the desired recruitment of the participants?

b) Were the study requirements too stringent and unacceptable, as indicated by the attrition rate?

c) Were randomization procedures acceptable to the participants?

d) Were the participants' burdens (i.e., procedures) practical and acceptable to the participants as indicated by the fidelity to procedures, submission of completed measures, and did they go to Lab Corp to provide serum samples?

e) Do the outcome measures indicate the effectiveness of the intervention?

By gathering information on these questions, we ensured that the large parent INDIRA study would be based on sound methods, the intervention would be feasible and acceptable to

participants, and the results would be helpful for the intended participants (Orsmond & Cohn, 2017; Polit & Beck, 2020).

Power

The sample size for pilot studies is small and has limited power to test the study hypothesis with statistically significant results (Bowen et al., 2009; Orsmond & Cohn, 2017). Several meditation feasibility studies reported that they were not powered to detect statistically significant differences in measures due to small sample sizes, in keeping with their intent to test the feasibility of the procedure and recommended larger sample sizes for the follow-up studies (Bormann et al., 2008; Carson et al., 2005; Danilewitz et al., 2016; Ernst et al., 2008; Gauthier et al., 2015; Steinberg et al., 2017; Wathugala et al., 2019).

Sample Size

For the future larger parent INDIRA study, we calculated the sample size using G * power application, with the statistical test of analysis of covariance (ANCOVA), with the family of F tests, with Cohen's *f* medium effect size of 0.20, error probability (a) of 0.05, power of 80%, that yielded a minimum sample required of 199 to provide adequate power for the study. Given the attrition rate, a sample of 254 would be required for the larger INDIRA study. The literature was reviewed for completion rates (100% to 72%) to determine the appropriate sample size (Ramos et al., 2022; Rothwell et al., 2018). Therefore, to address potential attrition, an additional 28% increase in participants (n = 55) will be recruited for the larger INDIRA RCT, resulting in a total sample of LKM (n= 127) and ACG (n=127) for a total of (n= 254).

In an integrated literature review of 20 studies on the effectiveness of mindfulness meditations for nurses and nursing students, 16 studies had a sample size of less than 40, and only four had a sample size of 40 to 100 (van der Reit et al., 2018). A meta-analysis of 38 RCTs on MBIs for chronic pain found that studies with sample sizes of 15 to 50 reported poor statistical findings (Hilton et al., 2017). In another meta-analysis of 28 RCTs on acceptance and MBIs for the treatment of chronic pain, sample sizes ranging from 9 to 59 found that the effect sizes for anxiety, depression, and quality of life were moderate (Cohen's 0.5) and significant effect (Cohen's 0.08) for pain interference (Veehof et al., 2016). Although the attrition rate for MBIs is 5% to 24% (Hurley et al., 2014), attrition rates for online health interventions for chronic pain were 0% in chronic musculoskeletal pain patients (Slattery et al., 2019). However, greater than 49% attrition rates were found in treatment as usual control groups (Shonin et al., 2015). The highest rates of attrition (> 50%) were in patients with migraine, headaches, and multiple pain sites and conditions (Slattery et al., 2019). Furthermore, a meta-analysis of 22 MBI studies with shorter and kindness-based interventions had lower attrition rates than control groups, which authors found could be due to the time commitment required rather than the type of intervention (Galante et al., 2014). Online interventions shorter than four weeks that provided monetary compensation were discovered to increase adherence in app-based MBIs (Ramos et al., 2022). The only current study on nurses' chronic pain using MBIs used an α of .05, a slight error of .20, and a confidence interval of 95% for a sample of 62 nurses but did not provide a rationale for their sample size (Lopes et al., 2019).

The literature support for the sample size for a pilot trial is as follows (see Table 3.1). The pilot study using LKM for patients with chronic low back pain reported a retention rate of 59%, leaving a sample of 43 (Carson et al., 2005). In a spirituality-based mantra meditation pilot study for veterans with post-traumatic stress disorder (PTSD), 33 were recruited, and 29 completed the study for a retention rate of 88% (Bormann et al., 2008). In an 8-week peer led, pilot feasibility RCT of mindfulness meditation compared to waitlist reported attrition among medical students had a retention rate of 60% (Danilewitz et al., 2016). In another pilot trial on cognitively based compassion training (CBCT) for 33 breast cancer survivors, the control group had a 94% retention rate. In contrast, the intervention group had a 75% retention rate (Dodds et al., 2015). A pilot RCT of MBSR with 22 nursing home residents had an attrition rate of 40% (Ernst et al., 2008). In a five-minute, MBI pilot study for 45 pediatric intensive care unit (ICU) nurses, 42 out of 45 (98%) completed the post-study survey, while (84%) 38 of 42 participated in the one-month survey (Gauthier et al., 2015). In a similar study in surgical ICU, a sample of 32 nurses reported a 100% retention rate in the MBI group and a 97% retention rate in the control group during an eight-week RCT for MBI versus light yoga control group (Steinberg et al., 2017). Similarly, Wathugala et al. (2019) reported a retention rate of 100% in a pilot study with a sample of ten chronic stroke survivors (see Table 3.1).

The average sample size of the listed studies in Table 3.1 is above 30. As the primary purpose of the pilot trials is not to test the effectiveness of the intervention but to evaluate the procedural steps, it is not necessary to calculate sample size using “formal power considerations” (Whitehead et al., 2016, p. 1058). Researchers suggest that the sample size of

Table 3.1

Review of Literature of Pilot Studies

Authors	Intervention & Focus Area	Sample	Analysis	Results	Recommendations
Bormann et al., 2008	6 weeks mantra meditation, veterans PTSD	33	Descriptive statistics	M ± SD effect size Cohen's d	Larger RCT for returning veterans
Carson et al., 2005	8 weeks LKM for CLBP	43 IG (n =18) CG (n = 25)	Multilevel modeling, Regression, Chi square	M ± SD	Calculate sample size prior to study
Danilewitz et al., 2016	8 weeks mindfulness program medical students	30 IG (n= 15) CG (n = 15)	ANCOVA	M ± SD within group effect size; between group effect size	Further research
Dodds et al., 2015	8 weeks CBT for breast cancer survivors	30 IG (n =15) CG (n =15)	ANCOVA	M + SD Differences between groups	Highly acceptable but needs broader testing with unbiased sample
Ernst et al., 2008	8 weeks MBSR for nursing home residents	22 IG (n=15) CG (7)	Multiple regression	Between group differences	Larger study with active control group
Gauthier et al., 2015	1-month MBI Nurses peds ICU	45	ANOVA independent t-tests)	Between group differences	Brief meditation for nurses on-job stress
Steinberg et al., 2017	8 weeks MBI & light yoga	33 IG (n = 16) CG (n= 17)	Two-tailed t tests, x^2	M ± SD	Need for workplace intervention with management support
Wathugala et al., 2019	Two weeks Chronic stroke	10	correlation	M ± SD	Larger sample with control group, web-based study

Note. PTSD = posttraumatic stress disorder; LKM = Loving Kindness Meditation; CLBP = chronic low back pain; IG = intervention group; CG = control group; M = mean; SD = standard deviation. ICU = Intensive care unit

the pilot study should be 10% of the parent study, with 10% added for attrition (Connelly, 2008; Lackey & Wingate, 1998; Treece & Treece, 1982). Authors Hill (1998) and Isaac & Michael (1995) stated that a pilot with a sample between 10 and 30 has practical advantages of ease in calculation, adds simplicity to complex design with large data, can test the hypothesis, and ignores weak effects. However, this sample should not be relied upon for generalizability but should only be used to inform larger parent studies (Herzog, 2008). Given this literature, we proposed the retention of 25 nurses for this pilot trial plus an additional 25% (n = 7) nurses for attrition, giving us a sample of 32 with n = 16 in the Loving Kindness Meditation (LKM) group and n = 16 in the active control group (ACG).

Sample Characteristics

The inclusion criteria for this study were nurses in the United States (U.S.) who were 18 years or older, who had experienced self-reported CP that had lasted for over three months, and who were current or past registrants with a state board of nursing in the U.S.; could read English; were computer literate; had Internet access; had time daily to practice meditation and self-care; could provide and mail pre-intervention and post-intervention serum samples, and could participate in daily surveys (see Table 3.2). The exclusion criteria excluded nurses who had participated in any formal meditation practice within the three months leading up to the study, were pregnant, were actively taking steroids, or had been diagnosed with Cushing's disease, as these conditions directly affect the production and reading of cortisol levels (Gard et al., 2012; Granger et al., 2009; Hibel et al., 2006).

Table 3.2

Participants Flowchart

Number of Participants
Stage I. Recruited (*n* = 80)
Stage II. Signed informed consent (*n* =54)
Stage III. Provided mailing address (*n* = 40)
Stage IV Randomized into LKM or ACG groups (*n* = 20)
Stage V. Completed pre-study surveys (*n* = 36)
Stage VI. Completed post-study surveys (*n* = 28)

Note. This table presents the number of participants (n) at each pilot study stage. LKM means the Loving Kindness Meditation group. ACG means the active control group through Positive Psychology.

Sampling Procedure

Facebook groups (FBGs) and social media sites provide easy access to samples (Jones, 2016). After obtaining written permission from these Facebook group creators, the University of Missouri (UMKC) Institutional Review Board (IRB) approved the link, and participants were recruited via social media. Potential participants were asked to share the link, meeting the internet snowball convenience sampling requirements (Kosinski et al., 2015). Through snowball sampling from the social media sites such as Kansas-Missouri FBGs, email contacts, and Twitter, a sample of 40 nurse participants who met the inclusion criteria was collected (see Table 3.2).

Setting

After approval from the UMKC IRB, an invitation link to participate in the study link was sent through Twitter, Instagram, professional email contact lists, and Facebook Support Groups (FBGs) for nurses in the greater Kansas City, Missouri metro area (Jones, 2016). As of February 3, 2022, the five main FBGs targeted for recruitment had a combined total membership of 51,407. Nurses who visit these FBGs are interested in gaining support for their practice, job opportunities, and personal encouragement. This provided a practical setting for convenience sampling of nurses from the target population (Morgan et al., 2013; Whitaker et al., 2017). The four main FBGs that were approached were: (a) Kansas City-based Nurses and Health Care Workers (20,900) members, an average of 10 posts per day): (b) Nurses KC (14,800 members, with four posts per day); (c) Holistic Nurses (1,900 members, average of one post per day); (d) Heart to Heart International List (Kansas-based group with 13,565 nurse, physician, and local medical-volunteer members; an average of one post per day), and (e) the Greater Kansas City Black Nurses Association (242 members, average of one post per week, emphasizing active community engagement).

Recruitment

After four weeks of daily social media recruitment, we recruited a sample of 80 nurses who were interested in participating in this pilot study. Fifty-four self-identified as having met the inclusion criteria and signed a consent form to participate in the study. Forty nurses provided their home mailing addresses to receive cortisol testing kits. Thus, we achieved the goal of retaining a total sample of 32 with equal representation in each group LKM (n = 16) and ACG (n = 16) (see Table 3.2; see Appendix B).

Measurements

Demographic data were collected through a 10-item survey regarding gender, ethnicity, employment setting, age, education, number of children, years of teaching, years of service, years of self-reported CP, frequency of prescription, and over-the-counter analgesic medication (see Table 4.1). The current "gold standard" in pain assessment is self-reporting, requiring participants to process internal information about the effects of an intervention and effectively and accurately communicate these personal experiences to researchers (Cowen et al., 2015; Polit & Beck, 2020). The INDIRA study collected the interventions' psychological and physiological outcomes through the short form of the following surveys.

The Numeric Pain Rating Scale (NPRS)

The dependent variable of CP is defined as pain lasting over three months, which interferes with daily activities (Martinez-Calderon et al., 2019). The impact of the independent variable LKM on CP was determined through the Numeric Pain Rating Scale (Cleeland & Ryan, 1994). In systematic reviews and meta-analyses, the NPRS has been used successfully in several studies to capture CP outcomes (Alghadir et al., 2018; Garland et al., 2020; Hilton et al., 2017; Kingsnorth et al., 2015; Modarresi et al., 2021). This tool assesses subjective information from participants through an 11-point rating scale that starts with the number 0, which indicates no pain and goes up to 10, which indicates the worst imaginable pain (Alghadir et al., 2018). The scale asks participants to select a single number to represent their pain when recalling their pain in the last 24 hours (Hjermstad et al., 2011). Compared to the visual pain rating scale, the numeric pain scale rating was preferred by CP patients to assess their pain levels (Alghadir et al., 2018). In a study with 121 subjects with osteoarthritic

knee pain, the intraclass correlation coefficient of NRS was 0.95, the standard error of measurement was 1.33, and NRS had higher reliability in the less educated and the elderly (Alghadir et al., 2018). The numeric pain rating scale had a good correlation with the severity of arthritis as seen on radiographic evidence and presented with excellent test-retest reliability (Alghadir et al., 2018). In a synthesis of 43 pain studies, the numeric pain scale provided reliable scores in most studies (Modarresi et al., 2021). Based on this literature review, NRS was used to collect evidence of the efficacy of the intervention on participants' chronic pain. Pre- and post-data were used to conduct an ANCOVA to determine the statistical difference between LKM and ACG on CP while controlling for self-reports of CP collected at T0.

The Perceived Stress Scale-10 (PSS-10)

The dependent variable of stress is defined as any reaction to stimuli that becomes overpowering or unpredictable or impacts one's ability to perform personal and professional tasks (Cohen et al., 1983). The PSS-10 has been used to check stress levels in MBIs according to several studies listed in trials, reviews, systematic reviews, and meta-analyses (Atanes et al., 2015; Coster et al., 2020; Mahon et al., 2017; Pardos-Gascón et al., 2021; Polich et al., 2010). The effectiveness of the independent variables on stress was determined using the Perceived Stress Scale (PSS). This 10-item survey uses a four-point scale (0 = never, 1 = almost never, 2 = sometimes, 3 = fairly often, or 4 = very often) to indicate perceived stress intensity levels (Cohen et al., 1988). Internal consistency of PSS on Cronbach's alpha (α) is .82–.91, and in 19 studies (Lee, 2012), test-retest reliability varied for two days (r = .85), one week (r = .74), two weeks (r = .77), and six weeks (r = .55) in 19

studies (n = 8702). Concurrent validity between PSS and the Medical Outcomes Study–Short Form 36 was r = -.70 for mental components and r = -.27 for physical components. Factorial validity for two factors was strongly correlated (r = .65) with a variance of 61.9% (Lee, 2012).

Caring Factor Survey–Care Provider Version (CFS-CPV)

Professional caring is defined as providing caring, loving, authentic, intentional, and technical care to patients (Watson, 2011). The CFS-CPV scale was developed to reflect the practices of the ten Caritas Factors (Nelson et al., 2016). The effectiveness of the independent variables on the CFS-CPV is determined using a 10-item survey measuring professional caring on a seven-point Likert scale (1 = strongly disagree to 7 = strongly agree). Reliability using Cronbach's alpha (α) is 0.95, internal consistency for items = 0.867, and content validity index ranges between 0.78 and 0.90 with item-total correlations of r < 0.3 (Vrbnjak et al., 2017). Concurrent validity for caring on Kaiser-Meyer-Olkin was .958, and Bartlett's test of sphericity for all items was $p < .001$, indicating that CFS-CPV is a good model fit for caring measures (Nelson et al., 2016). Additionally, a survey of 91 nurses using a Slovenian translation of the CSF-CPV was understood by the nurses, providing a content validity of 0.990 (Vrbnjak et al., 2017).

Self-Compassion Scale–Short Form

The effectiveness of the independent variables on self-compassion is determined using the Self-Compassion Scale–Short Form (SCS–SF). The Self-Compassion Scale has been used successfully to collect data in several MBIs (Atanes et al., 2015; Boellinghaus et al., 2014; Costa & Pinto-Gouveia, 2011; Costner et al., 2020; Lopes et al., 2019; Raab,

2014). This 12-item survey for self-compassion has an internal consistency of Cronbach's alpha (α) between .86–.92 and Pearson's correlation with PSS-14 at $r \geq 0.97$; test-retest reliability for one and three weeks was .93 in clinical and non-clinical samples (Raes et al., 2011). Concurrent validity with PSS-14 was $p < .001$ (Hayes et al., 2016).

Serum Cortisol Levels

The hypothalamic-pituitary-adrenal (HPA) axis secretion occurs due to stress and can be measured through serum and salivary cortisol (Matousek et al., 2010). The serum cortisol test collects data on the hypothalamic-pituitary-adrenal axis activation, which is triggered due to stress experienced during acute or CP (Abdallah & Geha, 2017; Tennant, 2013). The effectiveness of capturing the effects of MBIs on cortisol has been seen in many studies (Atanes et al., 2015; Granger, 2013; Nelson, 2015; Walvekar et al., 2015). The reference values for serum cortisol are 7–25 mcg/dL in the morning and 2–14 mcg/dL in the afternoon. In a systematic review of 156 National Institutes of Health patients, the correlation of cortisol for a 24-hour salivary sample and serum samples collected simultaneously was $r = 0.67$ (Papanicolaou et al., 2002).

Pulse Rate

Pain experience affects several physiological markers, including pulse rate (Cowen et al., 2015). Peripheral pulse rate is a marker of an autonomic nervous system pain assessment, which is easy to measure and non-invasive and accurately measures low, moderate, and severe pain-intensity levels (Cowen et al., 2015). Noxious input raises blood pressure, followed by an increased heart rate, measured on pulse oximetry or smartphone applications (Cividjian et al., 2007; Lamonaca et al., 2012). Assessing pain ratings objectively through

physiological markers has been used by several studies (Appelhans et al., 2008; Cheong et al., 2018; Cowen et al., 2015; Melia et al., 2015; Rathmell & Fields, 2012; Vlaeyen et al., 2016; Xiao et al., 2018). In a pain study, increased heart rate and blood pressure among unconscious or sedated patients indicated the presence of pain (Pudas-Tahka et al., 2009). Moreover, pulse rates in healthy individuals have decreased significantly after meditation (Peng et al., 2004; Sudsuang et al., 1991). The trained nurse participants recorded their pulse rates at baseline and after their intervention each week, either through a pulse oximeter, a smartphone application, or radial pulse palpitations for one minute (Hwu et al., 2000; Longmore et al., 2019).

Pain Medication Intake

Taking analgesic medication to manage pain is considered a passive activity, whereas participating in meditation or exercise is regarded as active coping (Mills et al., 2019). Several studies reported that the use and misuse of pain medications decreased post-MBIs (Arnstein et al., 2017; Cohen et al., 2015; Garland et al., 2015; Hilton et al., 2017; Innes et al., 2018; Jinich-Diamant et al., 2020; Ludwig & Kabat-Zinn, 2008). Pain medication intake that is over-the-counter (OTC) or prescribed pain medications that are needed to help nurses cope with CP are referred to in this study as analgesics (Crisp et al., 2021; Gatchel, 2005). Meditation-based interventions have led to changes in pain experiences and pain-coping strategies, including reduced intake of OTC and prescription pain medications (Hilton et al., 2017; Korn, 2016; Nicklas et al., 2010; Zeidan et al., 2010). The nurses self-reported the analgesics, defined for this study as the prescribed or OTC pain medications needed to

manage pain. In addition to outcomes of analgesic intake, data were collected to answer the following research questions on other study variables.

Research Questions and Hypotheses

Following are the research questions (RQ) and proposed hypotheses (H0), and alternatives (H10 for this pilot trial.

RQ 1) What was the feasibility of nurses with chronic pain participating in a three-week online intervention compared to a Positive Psychology education attention-control intervention?

RQ1a) To what extent did we successfully recruit the required sample nurses via social media and email?

RQ1 b) What was the attrition rate?

RQ1 c) To what extent were the intervention procedures implemented as planned?

RQ1 d) To what extent did the participants maintain adequate fidelity to the procedures?

RQ1 e) To what extent were the measures completed and submitted on time?

RQ1 f) What was the cost-benefit of using LetsGetChecked serum testing?

RQ 2) What was the acceptability of the study of using online asynchronized intervention for nurses' chronic pain outcomes?

RQ2 a) To what extent did the nurses accept mailing samples and retrieving results from LetsGetChecked?

RQ2 b) To what extent did the nurses accept their assignment in the control group?

Inferential statistics were conducted using analysis of covariance (ANCOVA) for the following questions:

RQ 3.1) To what extent and in what ways does the LKM influence self-reported CP at the end of an intervention after controlling for variability in initial self-reported CP?

(H_0 1) There will be no change in the mean value of the dependent variable of self-reported CP in the LKM group compared to the ACG group.

(H_a.1) The mean value of the dependent variable of self-reported CP will be lower in the LKM group compared to the ACG group.

RQ 3.2) To what extent and in what ways does the LKM influence stress at the end of an intervention after controlling for variability in initial self-reported CP?

(H_0 2) There will be no change in the mean value of the dependent variable of stress in the LKM group compared to the ACG group.

(H_a 2) There will be a change in the mean value of the dependent variable of stress will be lower in the LKM group compared to the ACG group.

RQ 3.3) To what extent and in what ways does the LKM influence self-compassion at the end of an intervention after controlling for variability in initial self-reported CP?

(H_0 3): There will be no change in the mean value of the dependent variable of self-compassion in the LKM group compared to the ACG group.

(H_a 3) There will be a change in the mean value of the dependent variable of self-compassion will be higher in the LKM group compared to the ACG group.

RQ 3.4) To what extent and in what ways does the LKM influence self-reported professional caring at the end of an intervention after controlling for variability in initial self-reported CP?

(H_0 4) There will be no change in the mean value of the dependent variable of professional caring in the LKM group compared to the ACG group.

(H_a 4) There will be a change in the mean value of the dependent variable of professional caring will be higher in the LKM group than in the ACG group.

RQ 3.5) To what extent and in what ways does the LKM influence serum cortisol at the end of intervention after controlling for variability in initial self-reported CP?

(H_0 5) There will be no change in the mean value of the dependent variable of serum cortisol among nurses in the LKM group compared to the ACG group.

(H_a 5) There will be a change in the mean value of the dependent variable of serum cortisol will be lower in the LKM group compared to the ACG group.

RQ3 6) To what extent and in what ways does the LKM influence self-reported pulse rate at the end of an intervention, after controlling for variability in initial self-reported CP with ordinal logistic regression?

(H0 6) There will be no change in the mean value dependent variable of pulse rate in the LKM group compared to the ACG.

(H_a 6) There will be a change in the mean value-dependent variable of self-compassion, which will be higher in the LKM group compared to the ACG group.

RQ 3.7. To what extent and in what ways does the LKM influence pain medication intake (PRN) at the end of an intervention after controlling for variability in initial self-reported CP with ordinal logistic regression?

(H_0 7) There will be no change in the mean value of the dependent variable of the PRN in the LKM group compared to the ACG group.

(H_a 7) There will be a change in the mean value of the dependent variable of the PRN will be lower in the LKM group compared to the ACG group.

Procedure

This section provides a step-by-step guide to executing the INDIRA study; these steps represent the procedures for implementing the interventions (see Figure 3.1).

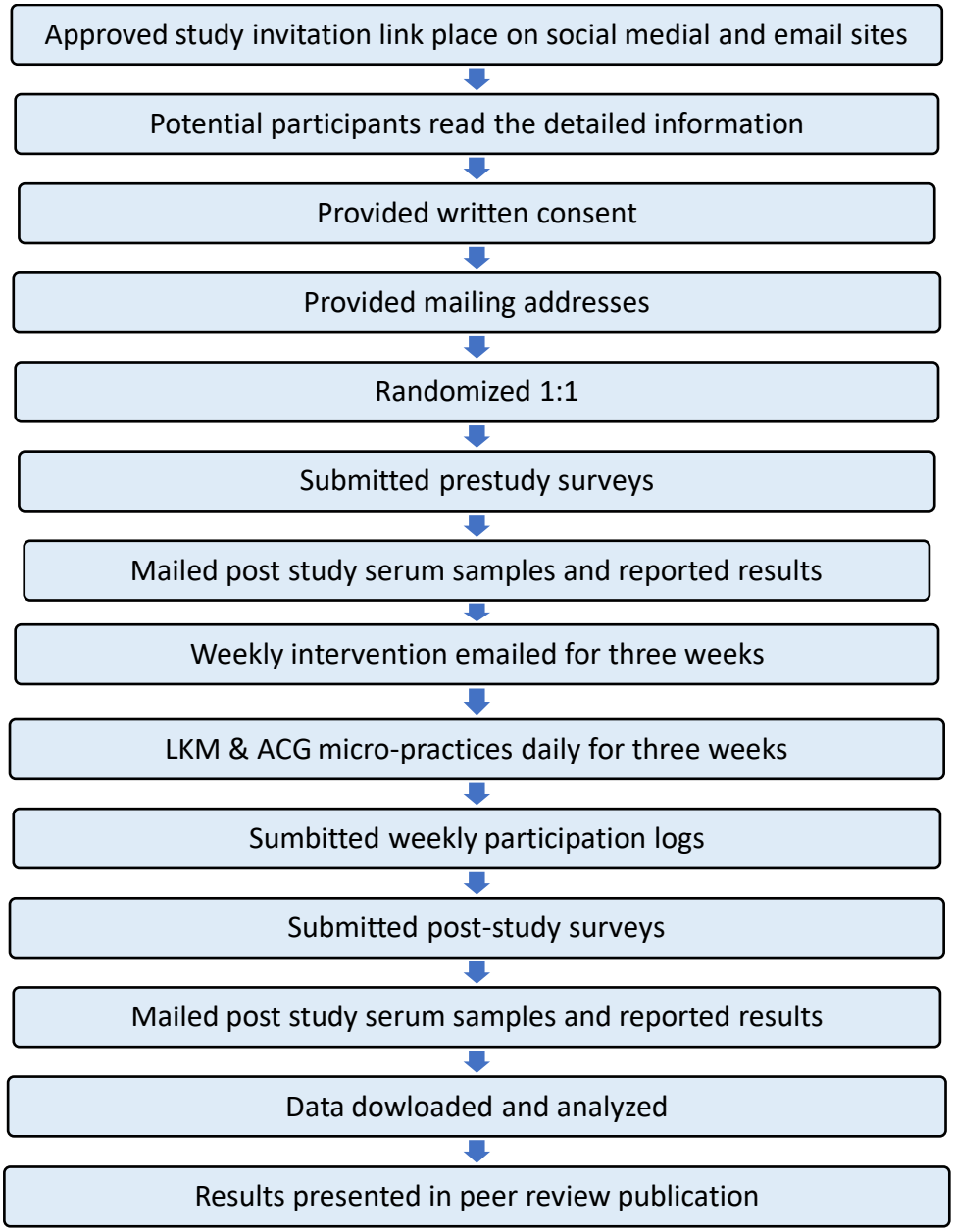
Step 1. After receiving IRB approval from UMKC, the approved recruitment advertisement was placed on FBG and disseminated via Twitter and professional emails. Interested nurses passed on the link to additional nurses who meet the inclusion criteria, fulfilling convenience and snowball sampling requirements.

Step 2. Once the interested nurses clicked on the link, they were redirected to an information page on Research Electronic Data Capture (REDCap) (Santacroce et al., 2004). This page provided information on the purpose of the study, answering the following questions:

- What are the inclusion and exclusion criteria?
- Why is it necessary to retain an adequate number of samples?
- How will the participants be randomized?
- How will the participants access the intervention?

Figure 3.1

Pilot Study Procedure Steps



- How will participants download meditation and TED Talks on their devices?
- What is the timeline for the study?
- How is the selection of instruments conducted?

- What is the importance of filling out the self-reports and taking serum cortisol levels quickly?
- How will this data be managed and stored?

Step 3. The participants were informed that they were free to withdraw from the study without penalty and that there were no physical risks to participation. They were also informed of potential benefits, including decreases in CP and improvements in well-being. The time required to fill out surveys was less than five minutes to complete the demographic survey and 20 minutes each to complete the pre-intervention (T0) and post-intervention (T1) instruments.

- The time commitment for the LKM included a few moments to practice self-compassionate micro-practices for a few moments throughout the day. Participants were encouraged to prioritize their care during this intervention (Griffin et al., 2021).
- In week one, the participants listened to a guided seven-minute meditation called Caring Moment by Dr. Jean Watson to reconnect with their true calling (Watson, 2011). On the following days, participants could either listen to the same guided meditation or 15-minute music by Jason Barrette created specifically for this intervention. Participants listened to these audio meditations at a place and time of their choosing.
- 1) On week two, the LKM activity was Serenity Pause (Taylor, 2012). Participants were encouraged to find a small space and time to draw in big, serene breaths while relaxing their bodies. On week two, the LKM activity was three

mindful breaths. Participants listened to guided 3-minute meditation (Sitzman & Craven, 2021).

3) On week three, the LKM activity was supportive touch with the hand to heart, activating the parasympathetic nervous system (Neff, 2018a). Participants were encouraged to understand that these self-care exercises were not to control what was happening around them but to embrace themselves with kindness and care (Neff, 2018b).

- The time commitment for the ACG was 15 minutes each Sunday to watch an inspirational TED Talk and approximately a few minutes per day to practice self-care recommended in the talks.

    1. A tribute to nurses, Carolyn Jones (2016). Nurses were invited to note at least three times during their day when a patient expressed appreciation for them.

    2. Thriving Under Pressure, Andrea DiNardo (2018). Nurses were invited to note, at least three times a day, how they met a challenge, applied creative control, and became comfortable with discomfort to achieve their goal.

    3. Want to Get Great at Something? Get a Coach. Dr. Atul Gawande (2017). Nurses were invited to note areas they will excel in and seek a coach to reach that goal.

- Both groups were encouraged to complete a weekly items survey on REDCap (Crisp et al., 2021; Nelson, 2015).

The four daily questions for both groups were (see Appendixes C and D):

a) I practiced compassionate micro actions of self self-care today.

(0 = did not practice; 1 = practiced once; 2 = practiced twice; 3 = practiced three times; 4 = practiced more than three times)

b) My radial pulse after the self-care practice was? bpm (beats per minute)

c) I needed prn pain medications to manage my pain today. On a scale of 0 to 4 (0 = no pain; 1 = mild pain managed without prn medications; 2 = moderate pain managed without prn medication; Alternatively, 3 = moderate pain required prn medication; 4= severe pain not relieved with prn medication)

These survey items provide reliable data on intervention fidelity (Eaton et al., 2011; Santacroce et al., 2004; Ybarra & Eaton, 2005).

- Contact information for the author and the UMKC Office of Research was included in the information sheet, which nurses could either read online or download to their devices.

Step 4. After reading the information sheet, the nurses provided written consent.

Step 5. After signing the consent forms, the participants were randomized 1:1 (Pan et al., 2013).

Step 6a. Both groups provided demographic information, pre-study surveys, and serum samples.

Step 6b. Participants were encouraged to log into REDCap each week to upload their participation data and submit them once a week to ensure their receipt of treatment (Bellg et al., 2004).

Step 7a. The LKM group practiced LKM micro-practices daily for three weeks (see Appendixes C, D, and E).

Step 7b. The ACG group listened to an inspirational TED Talk each Sunday and practiced suggested self-care micro-practices for three weeks.

Step 7c. Participants from both groups uploaded weekly survey questions on participation, pulse rate, and analgesic intake each week. This step confirmed their daily use of the tools (Bellg et al., 2004).

Step 8. To ensure retention, I monitored the return of participation data each week. If a participant did not submit a weekly questionnaire, a gentle reminder email was sent via REDCap (Jones, 2017).

Step 9 (T1) 9a. On the 21st day, both groups finished their micro-practices.

Step 9b. Both groups submitted their last weekly participation surveys.

Step 9c. Both groups submitted their post-intervention instruments.

Step 9d. Both groups provided a blood sample at LetsGetChecked before and after the study.

Step 10 (T1) Both groups uploaded their cortisol results via REDCap.

Step 11. To express our gratitude for participating, each nurse was given a 15-minute meditation by Jason Barrette as a gift. This music was especially created for this pilot study.

Step 13. Data were downloaded into SPSS and analyzed. The demographic data were analyzed using descriptive statistics and were reported as frequencies and percentages for nominal and ordinal level data (race, state of primary licensure, marital status, employment status, use of prescribed pain medication, and use of over-the-counter pain medication and mean range and standard deviation for ratio-level data on age (Munro, 2005). ANCOVA and OLR analysis revealed no statistically significant difference between the mean of the LKM

and ACG after controlling for covariate of pre-intervention (T0) of self-reported CP. However, based on positive participant feedback, a pre- and post-pairwise analysis was conducted, which revealed a statistical difference in all pairs except for the pre-PRN and post-PRN pair. These final results were saved in REDCap.

Step 14. The data output will be presented as an article manuscript with tables and submitted to a peer-reviewed journal for publication.

Importance of the Study's Fidelity

According to National Institutes of Health (NIH) guidelines, the fidelity of an online behavioral intervention can be controlled by a sound study design, training, treatment, receipt of treatment, and practicing the skills (Bellg et al., 2004). This study design is consistent with the theory of Adult Education and provides information that participants can use immediately to impact their practice (Blum, 2014; DeCelle, 2016). The engaging and soothing training materials from Watson's Caring Science Institute are used globally (Nelson & Watson, 2012). Weekly submissions of surveys were monitored. These two items provide reliable data on intervention fidelity (Santacroce et al., 2004; Ybarra & Eaton, 2005). In this manner, this study ensured the fidelity of this online intervention.

Importance of Preventing Attrition

Attrition is losing participants after baseline data collection and can affect the study's power, generalizability, reliability, validity, and reliability of results (Polit & Beck, 2020). The attrition rates are higher for long-term MBI interventions and clinical trials (Costner et al., 2020; Galante et al., 2014; Martinez-Calderon et al., 2019). In feasibility studies, the attrition rates ranged from 41% (Carson et al., 2005) to as low as 0% (Wathugala et al.,

2019). By providing varied weekly content, reducing the study to three weeks, providing prompt communication, creating manageable response time to questionnaires, and providing a gift of meditation music, we kept the attrition rate to 35% (n = 8). We retained 28 participants at the end of the study, thus meeting our goal of 23 participants for this study (Costner et al., 2020; Galante et al., 2014; Lam et al., 2015; Ramos et al., 2022).

Data Collection Plan

Data from REDCap were collected using reliable and valid measures. To increase the scientific rigor and objectivity of the self-reported data collection process, the physiological markers of serum cortisol levels and pulse rates were also collected (Cowen et al., 2015; Matousek et al., 2010). According to previous studies, the data collected were parametric, continuous, and relatively normally distributed except for pulse and PRN OTC PRN medication intake, which were collected on ordinal variables (Mossey & Gallagher, 2002), for stress (Lee, 2012), self-compassion (Nichols, 2019), professional caring (Nelson et al., 2016), serum cortisol (Li et al., 2016), pulse rate (Khalsa et al., 2015), and reduced analgesic intake (Hilton et al., 2017). The first data were collected (T0) at the beginning of the study, and the last data were collected at three weeks (T1). No other data collection is currently planned.

Data Analysis

Data were downloaded from REDCap and analyzed in the Statistical Package for the Social Sciences (SPSS) using t-tests and ANCOVA with an alpha of 0.05 to provide 95% power (Dodds et al., 2015). To avoid missing values during the study, the reason for each instrument's role in the overall study was carefully explained to the participants at intake

(Fink, 2015). Each participant was encouraged to take the survey when they had uninterrupted time and where they had maximum privacy (Fink, 2015). The participant feedback and weekly participation helped us analyze the following questions presented in Chapter 5.

RQ 1) What is the feasibility of nurses with chronic pain participating in a three-week online intervention compared to a Positive Psychology education attention-control intervention?

RQ1a) To what extent can we successfully recruit required sample nurses via social media and email?

RQ1 b) What is the attrition rate?

RQ1 c) To what extent can the intervention procedures be implemented as planned?

RQ1 d) To what extent do participants maintain adequate fidelity to the procedures?

RQ1 e) To what extent are the measures completed and submitted on time?

RQ1 f) To what extent was it cost-effective to use Lab Corps for cortisol serum testing?

RQ 2) What is the acceptability of the study of using online asynchronized intervention for nurses' chronic pain outcomes?

RQ2 a) To what extent did the nurses accept driving to Lab Corp for testing?

RQ2 b) To what extent did the nurses accept their assignment in the control group?

Inferential statistics were conducted using analysis of covariance (ANCOVA) with pre-study pain levels (pre-NPS as a covariate) for the following questions (Munro, 2005):

RQ 3) To what extent and in what ways does the LKM influence self-reported CP at the end of an intervention after controlling for variability in initial self-reported CP?

(H3 a: 0) There will be no change in the mean value of the dependent variable of self-reported CP in the LKM group compared to the ACG group.

(H3 a: 1) The mean value of the dependent variable of self-reported CP will be lower in the LKM group compared to the ACG group.

RQ3 b) To what extent and in what ways does the LKM influence stress at the end of an intervention, after controlling for variability in initial self-reported CP?

(H3 b: 0) There will be no change in the mean value of the dependent variable of stress in the LKM group compared to the ACG group.

(H3 b:1) There will be a change in the mean value of the dependent variable of stress will be lower in the LKM group compared to the ACG group.

RQ3 c) To what extent and in what ways does the LKM influence self-compassion at the end of an intervention, after controlling for variability in initial self-reported CP?

(H3 c: 0): There will be no change in the mean value of the dependent variable of self-compassion in the LKM group compared to the ACG group.

(H3 c: 1) There is a change in the mean value of the dependent variable of self-compassion will be higher in the LKM group compared to the ACG group.

RQ3 d) To what extent and in what ways does the LKM influence self-reported professional caring at the end of an intervention, after controlling for variability in initial self-reported CP?

(H3 d: 0) There will be no change in the mean value of the dependent variable of professional caring in the LKM group compared to the ACG group.

(H3 d:1) There will be a change in the mean value of the dependent variable of professional caring will be higher in the LKM group than in the ACG group.

RQ3 e) To what extent and in what ways does the LKM influence serum cortisol at the end of intervention after controlling for variability in initial self-reported CP?

(H3 e: 0) There will be no change in the mean value of the dependent variable of serum cortisol among nurses in the LKM group compared to the ACG group.

(H3 e: 1) There will be a change in the mean value of the dependent variable of serum cortisol will be lower in the LKM group compared to the ACG group.

Ordinal logistic regression was conducted to analyze the relationship between ordinal dependent variables (pulse and PRN medication) and two predictor variables of intervention and pre-NPS (Navarro & Foxcroft, 2018).

RQ3 f) To what extent and in what ways does the LKM influence self-reported pulse rate at the end of an intervention, after controlling for variability in initial self-reported CP?

(H3 f: 0) There will be no change in the mean value dependent variable of pulse rate in the LKM group compared to the ACG.

(H3 f: 1) There will be a change in the mean value-dependent variable of self-compassion will be higher in the LKM group compared to the ACG group.

RQ3 g) To what extent and in what ways does the LKM influence pain medication intake at the end of an intervention, after controlling for variability in initial self-reported CP?

(H3 g: 0) There will be no change in the mean value of the dependent variable of the average prescription medication intake in the LKM group compared to the ACG group.

(H3 g: 1) There will be a change in the mean value of the dependent variable of the average prescription pain medication intake will be lower in the LKM group compared to the ACG group.

Data Management

The T0 and T1 data will be housed in the REDCap Data Management system (Dodds, et al., 2015). REDCap is a HIPAA-compliant, encrypted, and secure web-based, metadata-driven software solution for research approved and supported by the UMKC Office of Research. I kept the data using a password-protected computer to access REDCap. REDCap data is maintained according to the University of Missouri IT system's highest security standards, isolated in cloud storage, in the server in the UMKC secure data center. This data protection system is classified at Level 4, the highest security level and one that satisfies HIPAA and Payment Card Industry (PCI) standards. Researchers can download copies of their raw data or leave them in REDCap. Once the data analyses are completed, the results will be stored in this secure REDCap site long-term.

Demographic Descriptive Statistics

The demographic survey has been analyzed initially using descriptive statistics in REDCap. The outputs represent frequencies and percentages for each demographic question (see Table 4.1 in Chapter 4).

The between-group differences were tested through ANCOVA to assess the mean difference between LKM and ACG when controlling for self-reported pre-intervention CP.

The correlation coefficient and significant *p*-values of the relationship between the dependent variable between intervention and covariate of CP are reported. A table of means group differences when adjusting for covariates of CP is presented for each question in Chapter 4. In addition, boxplots clearly did not show the presence of any outliers (Mishra et al., 2019; Parke, 2012). Based on previous studies, this data met the assumptions needed to conduct the statistical test (Atanes et al., 2015; Crisp et al., 2021; Lopes et al., 2019; White-Lewis et al., 2019).

ANCOVA Assumptions

- Assumption #1 was met for data for CP, stress, self-compassion, professional caring, pulse rate, and serum cortisol, which were continuous-level data. Post-pulse and post-PRN intake were collected as ordinal-level data and were analyzed through Jamovi version 2.1 (Navarro & Foxcroft, 2018).
- Assumption #2: The LKM and the ACG groups were independent, and no participants were enrolled in both groups.
- Assumption #3: There were no significant outliers.
- Assumption #4: Data were normally distributed.
- Assumption #5: Levene's tests confirmed the homogeneity of variance.
- Assumption #6: The sample size was greater than 30. We retained a total sample size of (n = 36). However, as they were divided into two groups, each group had less than 16 participants. Hertzog (2008) recommended that samples as small as 10 to 15 participants per group are adequate, depending on the purpose of the study. As this is a pilot study conducted with the aim of testing the feasibility and

acceptability of the larger parent INDIRA study, this sample size has given us informed criteria for success for the subsequent research (Polit & Beck, 2020). These assumptions are in keeping with those of similar studies (Crisp et al., 2021; Cronk, 2018; Kim & Park, 2019; Lopes et al., 2019; Morgan et al., 2013; Parker, 2012).

Summary

Chapter 3 presents the study design, setting, sample, operational definitions, measures, and procedures for the INDIRA study. Data analysis and evolution plan were presented using t-tests, ANCOVA, and Chi-square. Chapter 4 presents the results for the feasibility and acceptability of the INDIRA pilot trial and the CP outcomes resulting from participating in the online meditation-based intervention of LKM vs. ACG. In this step-by-step manner, I fulfill the goal of this INDIRA study and evaluate the impact of meditation-based intervention compared to the active control group on outcomes of CP, stress, self-compassion, professional caring, pulse rate, medication intake, and serum/salivary cortisol among nurses.

CHAPTER 4

RESULTS

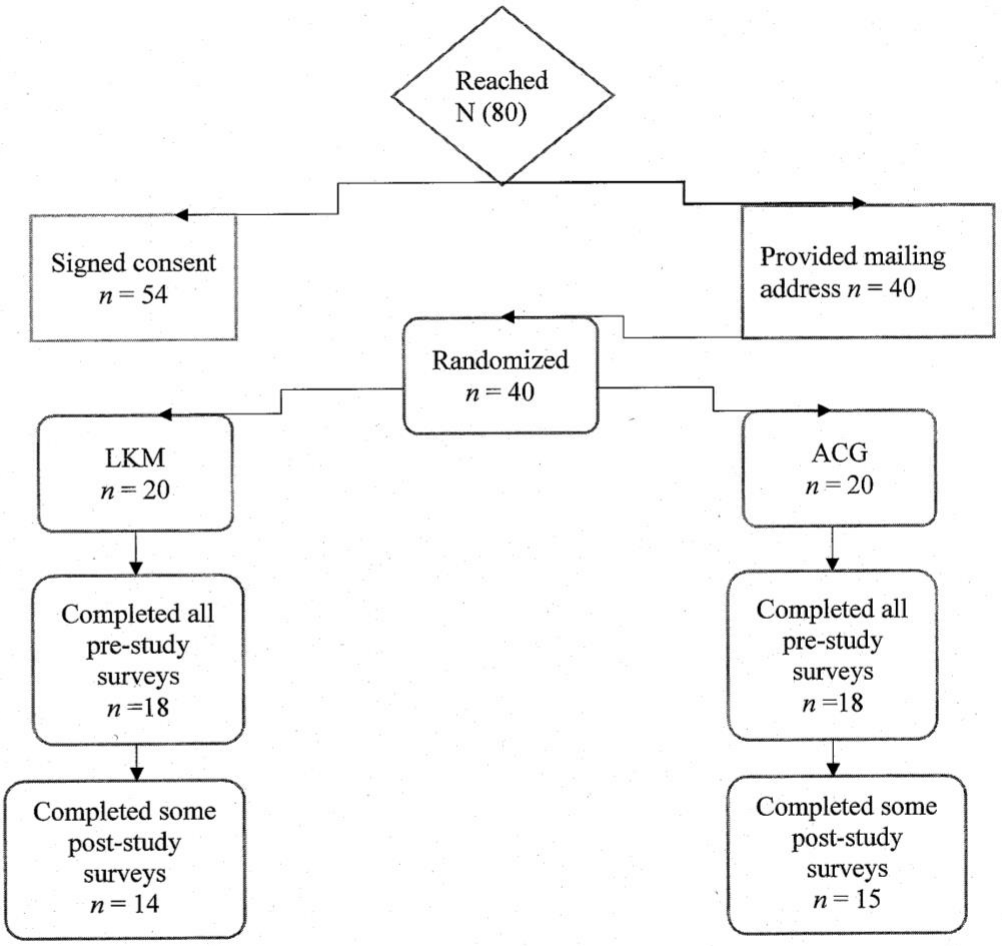
This chapter is organized by results from the demographic survey and primary research questions. Answers to feasibility and attrition are presented in Chapter 5. The descriptive statistics for each question are provided and demonstrated with tables. The post-study results are presented using analysis of the covariance (ANCOVA) results for the first five research questions with continuous dependent variables: pain, stress, self-compassion, care-providing factor, and cortisol. The categorical variables of post-intervention pulse rate and post-intervention need for over-the-counter pain medication were analyzed using ordinal linear regression (OLR), and the results are presented in this chapter.

Demographics

Initially, 80 potential participants responded to the social media invitation link and read the detailed information page on REDCap (see Figure 4.1). Fifty-four nurses signed the consent form to participate in the study. Forty provided mailing addresses to have serum cortisol kits sent to their homes. Once a sample of 40 participants was reached, Microsoft Random Generator in Excel was used to assign participants to loving kindness-based micro-practices (LKM) or positive-psychology-based micro-practices active control group (ACG). Thirty-six participants filled out all the pre-study surveys. Twenty-nine participants completed the study (see Figure 4.1). The CONSORT enrollment form is presented in Appendix B.

Figure 4.1

Flowchart of Participants' Decision



Note. This figure presents the number of participants (n) at each pilot study stage with two groups: the Loving Kindness Meditation group (LKM) and the active control group (ACG).

Forty nurses completed the ten-item demographic survey. Details of the demographic survey are presented in Table 4.1. Gender identifications were women (94.4%), one man (2.8%), and one non-binary person (2.8%), with an average age of 44 to 48. The majority of

Table 4.1

Demographic Survey

Variables	Sample	Percentages
Age		
18 to 23	1	2.8%
24 to 28	3	8.3%
29 to 33	0	0.0%
34 to 38	6	16.7%
39 to 43	2	5.6%
44 to 48	6	16.7%
49 to 53	8	22.2%
54 to 58	2	5.6%
59 to 63	6	16.7%
64 to 68	0	0
69 to 73	2	5.6%
Gender		
Woman	34	94.4%
Man	1	2.8%
Non-binary	1	2.8%
Registration		
Advanced Practice Registered Nurse	5	13.9%
Registered Nurse	29	80.6%
Licensed Practical Nurse	2	5.6%
State		
Arizona	1	2.8%
Colorado	1	2.8%
Florida	1	2.8%
Georgia	2	5.6%
Kansas	9	25%
Mississippi	1	2.8%
Missouri	13	36.1%
New Hampshire	3	8.3%
New York	1	2.8%
South Dakota	2	5.6%
Washington	1	2.8%
Wisconsin	1	2.8%
Employment		
Full time	32	88.9%
Part-time	2	5.6%
Full time student	2	5.6%
Years in nursing		
Less than 5 years	7	19.4%
6 to 10 years	3	8.3%
11 to 15 years	8	22.2%

(table continues)

16 to 20 years	5	13.9%
21 to 25 years	2	5.6%
25 to 30 years	3	8.3%
30 to 34 years	1	2.8%
35 to 39 years	4	11.1%
Over 40 years	3	8.3%
Primary function		
Direct patient care	22	61.1%
Indirect patient care	6	16.7%
Nursing Educator	8	22.2%
Duration of chronic pain		
3 months to 5 years	17	47.2%
6 to 10 years	14	38.9%
11 to 15 years	2	5.6%
16 to 20 years	1	2.8%
25 to 30 years	2	5.6%
Daily chronic pain		
Disagree	1	2.8%
Slightly agree	6	16.7%
Agree	21	58.3%
Strongly agree	8	22.2%
Daily PRN OTC meds for chronic pain		
Strongly disagree	1	2.8%
Disagree	3	8.3%
Slightly disagree	2	5.6%
Neutral	2	5.6%
Slightly agree	7	19.4%
Agree	11	30.6%
Strongly agree	10	27.8%

Note. This table presents the number of participants and percentages for each variable in the demographic survey.

the participants were registered nurses (RN, 29, 80.6%), with advanced practice registered nurses (APRN, 13.9%) and licensed practical nurses (LPN, 2, 5.6%) making up the rest of the group. Most participants (61.1%) were from Missouri and Kansas. They were employed full-time (89%) in direct patient care (61%) with a median service of 15 years. A significant percentage reported chronic pain (CP) from 3 months to 5 years (47.2%) and 6 to 10 years (38.9%). The majority stated they experienced CP daily (29, 80.5%) and needed over-the-counter (OTC), as-needed (PRN) pain medications daily to manage their CP (54.4%).

Research Questions

Research Question 1

To what extent and in what ways does the LKM influence self-reported CP at the end of the intervention in the LKM and ACG, after controlling for variability in initial self-reported CP?

- The H_0 for research question one is that there will be no change in the mean value of the dependent variable of stress in the LKM group compared to the ACG ($1H_0$: $\mu = \mu$).
- The H_1 for research question one is that there will be a change in the mean value of the dependent variable of pain will be lower in the LKM than in the ACG ($1H_1$: $\mu < \mu$).

The ratings for chronic pain were collected on an 11-point numeric pain scale (NPS), where zero was no pain, and 10 was the worst possible pain (Cleeland & Ryan, 1994). There were 26 participants in this model equally divided between the two groups for this model (see Table 4.2). An ANCOVA was conducted to determine the effect of the intervention on post-intervention pain (post-NPS) after controlling for pre-intervention pain (pre-NPS). There was heteroskedasticity; therefore, no linear relationship between pre-NPS and post-NPS as assessed by visual inspection of a scatterplot. A Pearson's correlation was run to assess the relationship between predictors and outcome, revealing that the predictor interaction $F(2, 24) = 2.05$, $p = .143$] and the predictor pre-NPS [$F(2, 24) = 2.05$, $p = .143$], were not significant for the outcome for the perceived chronic pain. Standardized residuals for the interventions and the overall model were normally distributed, as assessed by visual

inspection of the histogram. Levene's test of homogeneity of variance (p = .002) indicates that equal variances for this model are not assumed.

After adjustment for pre-NPS, after adjustment for pre-NPS, the ANCOVA model showed no statistically significant difference between groups for the Numerical Pain Scale ratings (see Table 4.2). The ANCOVA results showed non-significant post-numeric pain interactions between groups with LKM (n =13, M = 3.38, SD = 2.14) and the ACG (n = 13, M = 3.15, SD = .801), $F(1, 23) = 0.06$, p = .803, partial η^2 = .00 (see Table 4.2 and Table 4.3). The results show no difference in the mean values of the self-reported CP in the LKM compared to the ACG. Based on these nonsignificant results, we retain the null hypothesis for research question one, that the means between groups are not different for self-reported pain levels at the end of the study.

Table 4.2

Descriptive Statistics for Post-Intervention

Dependent Variable	Independent Variable	Sample	Mean	Standard Deviation
Post-NPS	LKM	13	3.35	2.14
	ACG	13	3.15	.801
	Groups Total	26	3.27	1.589

Table 4.3

Score Results for Post-Intervention Numerical Pain Scale Rating

Dependent Variable	F	*p*	η^2
Post-NPS	0.063	.803	.003

Note. NPS = Numerical Pain Scale. F =Critical Factor. p= significance value. η^2 = Eta squared

Research Question 2

To what extent and in what ways does the LKM influence stress as collected through perceived stress scale short form (PSS) at the end of the intervention in the LKM and ACG, after controlling for variability in the initial self-reported CP?

- The H_0 for research question two is that there will be no change in the mean value of the dependent variable of stress in the LKM group compared to the ACG ($2H_0$: $\mu = \mu$).
- The H_1 for research question two is that there will be a change in the mean value of the dependent variable of stress will be lower in the LKM than in the ACG ($2H_1$: $\mu < \mu$).

The ratings for stress were collected through the perceived stress scale (PSS-10). The data were collected through a five-point Likert scale for ten questions (Lee, 2012). There were 27 participants in this model, LKM (13) and ACG (14) (see Table 4.4). An ANCOVA was run to determine the effect of the intervention on post-intervention stress (post-PSS) after controlling for pre-intervention pain (pre-NPS). There was heteroskedasticity and no linear relationship between predictors and post-NPS as assessed by visual inspection of the scatterplot. A Pearson's correlation was run to assess the relationship between predictors and outcome, revealing that the predictor interaction [$F(2, 26) = 2.05$, $p = .143$] and pre-NPS [$F(1, 26) = .30$, $p = .119$] were not significant on perceived stress outcome. Standardized residuals for the interventions and the overall model were normally distributed, as assessed by the histogram ($M = 3.27$, $SD = 1.589$). Levene's test was not significant ($p = .657$), indicating that homogeneity of variances was assumed.

After adjustment for pre-PSS and pre-NPS, the ANCOVA model showed no statistically significant difference between groups for post-intervention Perceived Stress Rating (see Table 4.4). The ANCOVA results showed non-significant post-perceived stress interactions between groups, and nonstatistical in perceived stress interactions between the intervention (LKM) group (M = 16.77, SD = 5.53) and the control (ACG) group (M= 13.28, SD 5.48), $F(1, 25) = 2.17$, $p = .154$, partial $\eta 2 = .08$ (see Table 4.5). The results show no difference in the mean values of the self-reported perceived stress in the LKM compared to the ACG. Based on these nonsignificant results, we retain the null hypothesis for research question two, that the means between groups are not different for self-reported perceived stress at the end of the study.

Table 4.4

Descriptive Statistics for Post-Intervention Perceived Stress Rating

Dependent Variable	Independent Variable	Sample	Mean	Standard Deviation
Post-PSS	LKM	13	16.7692	5.52500
	ACG	14	13.2857	5.54832
	Groups Total	27	14.9630	5.68048

Note. Post-PSS = Perceived Stress Scale

Table 4.5

Score Results for Post-Intervention Perceived Stress Score

Dependent Variable	F	*p*	η^2
Post-PSS	2.166	.154	.083

Note. Post-PSS = perceived stress scale. *F* = Critical Factor. *p*= significance value. $\eta^{2 =}$ Eta squared

Research Question 3

To what extent and in what ways does the LKM influence self-compassion as collected on the Self-Compassion Scale Short Form (SCS-SF), at the end of the intervention in LKM and ACG, after controlling for variability in the initial self-reported CP?

- The H_0 for research question three is that there will be no change in the mean value of the dependent variable of self-compassion in the LKM compared to the ACG ($3H_0$: $\mu = \mu$).
- The H_1 for research question three is that there will be a change in the mean value of the dependent variable of self-compassion will be higher in the LKM than in the ACG ($3H_0$: $\mu > \mu$).

The ratings for self-compassion were collected through the Self-Compassion Scale Short Form (SCS-SF) on a seven-point scale for ten questions (Atanes et al., 2015). There were 28 participants in this model, LKM (13) and ACG (15) (see Table 4.6). An ANCOVA was run to determine the effect of the intervention on post-intervention self-compassion (post-SCS) after controlling for pre-intervention pain (pre-NPS). There was heteroskedasticity and no linear relationship between predictors and post-SCS-SF as assessed by visual inspection of the scatterplot. A Pearson's correlation was run to assess the relationship between predictors and outcomes. revealing that the predictor interaction [$F(1, 28) = 0.17$, $p = .143$] and pre-NPS [$F(1, 28) = -0.37$, $p = .051$] were not significantly correlated on post-intervention self-compassion outcome. Standardized residuals for the interventions and the overall model were normally distributed, as assessed by the histogram ($M = 3.27$, $SD = 1.589$). Standardized residuals for the interventions and the overall model

were normally distributed, as assessed by the histogram (M = 3.27, SD. = 1.59). Levene's test was not significant (p = .994), indicating that homogeneity of variances was assumed.

After adjustment for pre-NPS, the ANCOVA model showed no statistically significant difference between groups for post-intervention self-compassion ratings (see Table 4.6). The ANCOVA results showed non-significant post-interactions between groups and nonstatistical significant difference in self-compassion interactions between the intervention (LKM) group (M = 3.22, SE = 5.53) and the control (ACG) group (M= 3.22, SE .128), $F(1, 28) = 0.41$, p = .526, partial $\eta 2$ = .01 (see Table 4.7). The results show no difference in the mean values of self-reported self-compassion in the LKM compared to the ACG. Based on these nonsignificant results, we retain the null hypothesis for research question three, that the means between groups are not different for self-reported self-compassion at the end of the intervention.

Table 4.6

Descriptive Statistics for Post-Intervention Self-compassion Rating

Dependent Variable	Independent Variable	Sample	Mean	Standard Deviation
Post-SCS	LKM	13	3.1977	.47438
	ACG	15	3.3588	.48845
	Groups Total	28	3.2840	.48002

Note. SCS= Self Compassion Scale

Table 4.7

Score Results for Post-Intervention Self-Compassion Scale

Dependent Variable	F	*p*	η^2
Post-SCS	.414	.526	.016

Note. SCS = Self-Compassion Scale. *F* = Critical Factor. *p*= significance value. η^2 = Eta squared

Research Question 4

To what extent and in what ways does the LKM influence the self-reported care provider survey (CPS) at the end of intervention at the end of the intervention in LKM and ACG group, at the end of the intervention in LKM and ACG group, after controlling for variability in initial self-reported CP?

- The H_0 for research question four is that there will be no change in the mean value of the dependent variable of professional caring in the LKM group compared to the ACG ($4H_0$: $\mu = \mu$).
- The H_1 for research question four is that there will be a change in the mean value of the dependent variable of professional caring will be higher in the LKM group than in the ACG ($4H_0$: $\mu > \mu$).

The ratings for caring were collected on the Care Provider Survey (short form version) (CPV). The data were collected on a seven-point scale of 10 questions (Nelson et al., 2016). There were 27 participants in this ANCOVA model, LKM (12) and ACG (15), as listed in Table 4.8. An ANCOVA was run to determine the effect of the intervention on the post-intervention care-provider survey (post-CPV) after controlling for pre-intervention pain (pre-NPS). There was heteroskedasticity and no linear relationship between predictors and

post-SCS-SF as assessed by visual inspection of the scatterplot. A Pearson's correlation was run to evaluate the relationship between predictors and outcomes between predictors and outcomes, revealing that the predictor interaction [F(1, 27) = 0.09, p = .659] and pre-NPS [F(1, 27) = 0.03, p = .895] were not significantly correlated with post-CPS-CPV. Standardized residuals for the interventions and the overall model were normally distributed, as assessed by the histogram (M = 6.36, SE = .15). Levene's test was not significant (p = .609), indicating that homogeneity of variances was assumed.

After adjustment for pre-NPS, the ANCOVA model showed no statistically significant difference between groups for post-intervention caring factors for care provider rations (see Table 4.8). The ANCOVA results showed non-significant post-interactions between groups and no statistically significant difference in caring factor interactions between the intervention (LKM) group (M = 6.36, SE = .15). The control (ACG) group (M= 6.45, SE .14), F(1, 26) = 0.20, p = .656, partial η2 = .01 (see Table 4.9). The results show no difference in the mean values of the self-reported care-providing factor in the LKM compared to the ACG. Based on these nonsignificant results, we retain the null hypothesis for research question four, that the means between groups are not different for self-reported caring providing factors at the end of the intervention.

Table 4.8

Descriptive Statistics, Caring Factor Survey–Care Provider Version (CFS-CPV)

Dependent Variable	Independent Variable	Sample	Mean	Standard Deviation
Post-CPV	LKM	12	6.3621	.54387
	ACG	15	6.4520	.49940
	Groups Total	27	6.4120	.51138

Note. Post-CPV = Post-intervention Caring Factor Survey–Care Provider Version (CFS-CPV)

Table 4.9

Score Results for Post-Intervention Care Factor Survey, Care Provider Version

Dependent Variable	F	*p*	η^2
Post-CFS-CPV	.203	.656	.008

Note. SCS = Self-Compassion Scale. *F = Critical Factor*. *p*= significance value. η^2 = Eta squared

Research Question 5

To what extent and in what ways does the LKM influence serum cortisol at the end of the intervention in LKM and ACG groups after controlling for variability in initial self-reported CP?

- The H_0 for research question five is: There will be no change in the mean value of the dependent variable of serum cortisol among nurses in the LKM group compared to the ACG (5H0: $\mu = \mu$).
- The H_1 for research question five is that a change in the mean value of the dependent variable of serum cortisol will be lower in the LKM group than in the ACG (5H0: $\mu < \mu$).

The values for cortisol were collected through morning serum samples (Matousek et al., 2010). There were 24 participants in this model, LKM (11) and ACG (13) (see Table 4.10). An ANCOVA was run to determine the effect of the intervention on the post-intervention serum cortisol levels after controlling for pre-intervention pain (pre-NPS). There was heteroskedasticity and no linear relationship between predictors and post-SCS-SF as assessed by visual inspection of the scatterplot. A Pearson's correlation was run to determine the relationship between predictors and outcomes, revealing that the predictor interaction [F(1, 24) = -0.04, p = .831] and pre-NPS [F(1, 24) = 0.27, p = .200] were not significantly correlated with post-intervention cortisol serum. Standardized residuals for the interventions and the overall model were normally distributed, as assessed by the histogram (M = 10.58 SE = 1.82). Levene's test was not significant (p = .186), indicating that homogeneity of variances was assumed.

After adjustment for the covariate of pre-NPS, the ANCOVA model showed no statistically significant difference between groups for post-intervention serum cortisol results (see Table 4.10). The ANCOVA results showed no statistically significant difference in the interactions for serum cortisol between the intervention (LKM) group (M = 10.58 SE = 1.82) and the control (ACG) group (M= 10.32, SE .17), F(1, 24) = 0.01, p = .917, partial η2 = .00 (see Table 4.11). The results show no difference in the mean values of serum cortisol in the LKM compared to the ACG groups. Based on these nonsignificant results, we retain the null hypothesis for research question five, that the means between groups are not different for serum cortisol results at the end of the intervention.

Table 4.10

Descriptive Statistics for Post-Intervention Serum Cortisol

Dependent Variable	Independent Variable	Sample	Mean	Standard Deviation
Post-Cortisol	LKM	11	10.7364	4.22381
	ACG	13	10.1923	7.35702
	Groups Total	24	10.4417	6.00608

Table 4.11

Score Results for Post-Intervention Serum Cortisol Results

Dependent Variable	F	*p*	η^2
Post-Cortisol	.011	.917	.001

Note. F = Critical Factor. *p*= significance value. η^2 = Eta squared

Research Question 6

To what extent and in what ways does the LKM influence self-reported pulse rate at the end of intervention after controlling for variability in initial self-reported CP?

- The H_0 for research question six is that there will be no change in the mean value dependent variable of pulse rate in the LKM group compared to the ACG. ($7H_0$: $\mu = \mu$).
- The H_1 for research question six is that there will be a change in the mean value-dependent variable of self-compassion will be higher in the LKM group than in the ACG ($7H_0$: $\mu < \mu$).

The post-pulse rate data was collected through five-level ordinal data (Cowen et al., 2015). The analysis was performed using Jamovi Version 2.1 (Navarro & Foxcroft, 2018).

Data for 29 participants were available for analysis, with 14 participants in the LKM group and 15 participants in the ACG group (see Table 4.12). A Pearson's correlation was conducted to see the strength of the association between predictor variables and outcome. The results showed no significant relationship between the last-pulse rate and pre-NPS (r = 0.37, p = .054) and the last-pulse rate and intervention (r = 15, p = 0.444), indicating no significant relationships. There was heteroskedasticity and no linear relationship between predictors and post-pulse rate as assessed by visual inspection of the scatterplot. The plots graphs showed equal distribution of data.

The ordinal logistic regression model (OLR) showed no statistically significant difference between groups for post-intervention pulse rate results. The OLR results showed no statistically significant difference in the interactions for post-pulse rate between the intervention.

The post-pulse data for the intervention were collected on an ordinal variable. Therefore, an ordinal logistic regression was performed to predict the radial pulse rate (post-pulse) from two predictors, preintervention pain scale (pre-NPS) and intervention (LKM and ACG). A test of the entire model with two predictors (pre-NPS & intervention) as a set for change in post-pulse against a constant-only model was not significantly significant. These results indicated that the predictors, taken as a set, did not significantly predict the post-intervention pulse rate. A model coefficient for post-pulse was conducted for the predictors of pre-NPS and intervention. The output showed that the predictor of pre-NPS was not statistically significant $\chi 2(2) = 4.29$, $p = .117$, Nagelkerke $R^2 = .0805$ (see Table 4.12). These results indicated that the predictors, taken as a set, did not significantly predict the post-

intervention OTC PRN medication intake. A model coefficient for post-PRN was conducted for the predictors of pre-NPS and intervention. Pre-NPS was not a significant predictor of the last pulse rate [OR = 1.59, (95% CI, 0.974 to 2.83), z = 1.74, p = .082] (see Table 4.13). Likewise, the predictor intervention (LKM and ACG) was not significant in affecting post-pulse rate [OR = 1.61, (95% CI, 0.387 to 7.02), z = 0.65, p = .513].

Table 4.12

Descriptive Statistics for Post-Intervention Pulse Rate

Intervention	Sample	Mean	Standard Deviation
LKM	14	3.2857	1.32599
ACG	15	3.2667	.88372
Groups Total	29	3.2759	1.09859

Table 4.13

Results for Post-Intervention Pulse Rate

Dependent Variable	R^2_N	X^2	df	p
Post-Pulse	.0805	4.29	2	0.117

Note. Post-Pulse = Post-study pulse rate. R2N = Nagelkerke R Squared. df= degrees of freedom. p = significance value. The dependent variable "Pulse_last" has the following order: 50 to 60 beats per minute | 60 to 70 beats per minute | 70 to 80 beats per minute | Over 80 beats per minute

Research Question 7

To what extent and in what ways does the LKM influence as-needed over-the-counter analgesic intake at the end of intervention after controlling for variability in initial self-reported CP?

- The H_0 for research question seven is that there will be no change in the mean value of the dependent variable of the OTC intake in the LKM compared to the ACG (8H0: $\mu = \mu$).
- The H_1 for research question seven is that there will be a change in the mean value of the dependent variable of the OTC intake (8H0: $\mu < \mu$).

The post-intervention medication intake rate data was collected through five-level ordinal data (Mills et al., 2019). The post-pulse data for the intervention was collected on an ordinal variable. Data for 29 participants were available for analysis, with 18 participants in the LKM group and 18 in the ACG group (see Table 4.14). A Pearson's correlation was conducted to see the strength of the association between predictor variables and outcome. The results showed no significant relationship between the last-PRN rate and pre-NPS (r = 0.000, $p = 1$) and the last-pulse rate and intervention (r = -0.038, $p = 0.844$), indicating no significant relationships. There was heteroskedasticity and no linear relationship between predictors and post-pulse rate as assessed by visual inspection of the scatterplot. The plots showed equal distribution of data.

The ordinal regression model (OLR) showed no statistically significant difference between groups for post-intervention pulse rate results (see Table 4.14). An ordinal logistic regression (OLR) was performed to predict the radial pulse rate (post-pulse) from two predictors, preintervention pain scale (pre-NPS) and intervention (LKM and ACG). A test of the entire model with two predictors (pre-NPS and intervention) as a set for change in post-PRN against a constant-only model was not significantly significant $\chi 2(2) = 4.29$, $p = .117$, Nagelkerke $R^2 = .0805$ (see Table 4.15). These results indicated that the predictors, taken as a

set, did not significantly predict the post-intervention OTC PRN medication intake. A model coefficient for post-PRN was conducted for the predictors of pre-NPS and intervention. The predictor pre-NPS was not a significant predictor of the last pulse rate OR = 1.30, (95% CI, 0.821 to 2.06), z = 1.13, *p* = .257. Likewise, the predictor intervention (LKM and ACG) was not significant in affecting the post-PRN rate [OR = 0.94, (95% CI, 0.242 to 3.61), z = -0.0945, *p* = 0.925).

Table 4.14

Descriptive Statistics for Post-Intervention PRN Pain Medication Intake

Intervention	Sample	Mean	Standard Deviation
LKM	14	1.1429	1.16732
ACG	15	1.0667	.88372
Groups Total	29	1.1034	1.01224

Table 4.15

Results for Post-Intervention as PRN OTC Pain Medication Intake

Dependent Variable	R^2_N	X^2	df	*p*
Post-PRN	0.0215	1.27	2	0.529

Note. Post-PRN = As-needed over-the-counter pain medication. R^2_N = Nagelkerke R Squared. df= degrees of freedom. *p* = significance value. The dependent variable "PRN_last" has the following order: Never | Rarely | Sometimes | Often | Always

CHAPTER 5

DISCUSSION OF RESULTS

In this chapter, feasibility, acceptability, recruitment, intervention implementation, and attrition are presented. Additionally, the benefits of online research procedures and the benefits and drawbacks of the at-home serum sample done through the lab called LetsGetChecked are discussed. The results of the intervention for each of the dependent variables, as fitted in the analysis models, are then presented. Finally, the implications, limitations, direction for future research, and conclusion with a brief overview of the INDIRA pilot study are provided.

Study Feasibility

1. The first feasibility question was, was there a demand for this study, as indicated by the desired recruitment of the participants?

After a month of online recruitment, we reached our desired sample size. Participants' full interest was indicated by signing the consent form and providing their mailing address to receive the at-home pre-study and post-study LetsGetChecked cortisol kits. Only two participants were known to the student investigator; the remainder of the sample was recruited through social media. This INDIRA pilot study provided a random sample across the mainland United States (U.S.), from New York to Florida. However, the majority of the participants (n = 22, 61.1%) were from Kansas and Missouri, indicating the success of snowball recruiting through local nurses' Facebook groups, which had approximately 51,000 members (Kosinski et al., 2015).

Based on these results, there was a demand for this study, as the required number of participants was quickly attained.

2. Were the study requirements too stringent or unacceptable, as indicated by the attrition rate?

The attrition rate of participation was a total of five participants who did not provide any feedback related to their attrition. Two participants in the LKM group withdrew due to work-related conflict. There were no complaints about the requirements for the study. This led to the conclusion that the study requirements were reasonable and acceptable, as the attrition rate was 20%.

3. Were randomization procedures acceptable to the participants?

The randomization process was double-blind. Both groups' weekly instructions looked alike (see Appendix C and Appendix D). Therefore, it was not easy to differentiate the groups from each other unless someone read thoroughly the weekly instructions to nurses. Moreover, to the researcher's knowledge, no participants knew each other. There were no requests from participants asking to switch groups. This leads to the conclusion that the randomization process was acceptable to participants.

4. Were the participants' burdens (i.e., procedures) practical and acceptable to the participants as indicated by the fidelity to procedures, submission of completed measures, and mailing their serum cortisol sample to LetsGetChecked?

Twenty-nine of the 36 participants who started the study submitted all survey responses. The weekly instructions reminded the nurses of the value of the data collected for each response. Due to the double blind nature of the study, it was impossible to view

Research Electronic Data Capture (REDCap) to determine which participants had missed a survey until the end of the study.

Based on another recent literature review, this is the first national pilot study using at-home serum cortisol testing kits with nurses. The procedure to order serum cortisol kits from LetsGetChecked was easy for the research team. The support staff at LetsGetChecked were accommodating in the process and created an identification for each study participant. The serum kits were meant to reach the nurses in two days via United Parcel Service (UPS). Furthermore, the kits could be mailed postage-paid to the labs in two days via United Parcel Service.

The results, according to LetsGetChecked, should have been ready in 72 hours. Due to the Health Insurance Portability and Accountability Act (HIPAA) law, only participants could access their results through a secure login number. However, some participants in rural areas had to wait five days or more to receive their kits. Many of them also waited over a week to get their results back after the results had reached the lab. The results of two of the participants were hemolyzed, so the sample could not be read. Two participants complained that they could not draw enough blood to obtain the eight drops required to fill the test kit. Two participants lost that code and did not have time to call LetsGetChecked during the day. These unanticipated issues were experienced by six of the total participant group.

It should be noted that these individuals continued participating in the study without providing cortisol results. The remaining participants voiced no complaints related to the collection of serum cortisol. Two participants known to the investigators stated they preferred the at-home kit as they thought the LetsGetChecked experience would benefit busy

nurses and other clinical and non-clinical participants. According to Pipe et al. (2012), participants who cannot recall their codes have difficulty completing survey collection. Therefore, having direct access to the serum cortisol results would reduce the participants' burden, giving researchers direct access to the samples and results (Nelson, 2015; Pipe et al., 2012; White-Lewis et al., 2019).

5. Do the outcome measures indicate the effectiveness of the intervention?

The analysis of covariance (ANCOVA) results did not indicate differences in the means of the groups, as demonstrated by the results. However, as early as week one and as late as a month after the study's conclusion, emails were being sent from participants to the research team, sharing positive results (see Appendix F). One participant stated, "I had a really stressful week leading into yesterday and thought my results would be higher than my baseline, but I was very surprised to learn it came back at less than half." Another participant stated, "I am not one to use meditation or relaxation techniques; however, during your study, I used the techniques offered each week. I continue to use them as needed, and I have found they do relax me." A nurse who is a mother of four, works full time, and is in the final semester of nurse practitioner training, reported that this study helped her deal with stress and pain while improving her sleep hygiene.

Another participant reported that she repeatedly listens to Dr. Watson's meditation, which reminds nurses about their purpose. Based on the responses from participants, a pair-wise t-test was conducted through the Statistical Package for the Social Sciences version 29 (SPSS). The results indicated a difference in the means of each pre- and post-group (see Table 5.1). The pair samples correlation showed a statistically significant difference between

pre- and post-tests for most pairs, except pre- and post-numerical pain scale (NPS), and for pre- and post-need for as-needed, over-the-counter pain medication (PRN) (see Table 5.2), indicating that although the pain levels and need for pain medication did not change, there was some change within them.

Table 5.1

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PreNPS	4.58	26	1.604	.315
	PostNPS	3.27	26	1.589	.312
Pair 2	PrePSS	19.9259	27	5.69700	1.09639
	PostPSS	14.9630	27	5.68048	1.09321
Pair 3	PreSCS	2.9018	28	.51590	.09750
	PostSCS	3.2840	28	.48002	.09072
Pair 4	Precortisol	12.943	23	6.7445	1.4063
	Postcortisol	10.1739	23	5.99282	1.24959
Pair 5	PreCPS	6.1930	27	.57210	.11010
	PostCPS	6.4120	27	.51138	.09842
Pair 6	Pre_pulse	3.8276	29	.88918	.16512
	Post_pulse	3.2759	29	1.09859	.20400
Pair 7	Pre_PRN	1.0000	29	1.25357	.23278
	Post_PRN	1.1034	29	1.01224	.18797

Note. N=Sample. Std. Deviation = Standard Deviation. Std. Error Means

Table 5.2

Paired Samples Correlations

		N	Correlation	Significance One-sided *p*
Pair 1	PreNPS & PostNPS	26	.188	.179
Pair 2	PrePSS & PostPSS	27	.487	.005
Pair 3	PreSCS & PostSCS	28	.577	<.001
Pair 4	Precortisol & Postcortisol	23	.191	.191
Pair 5	PreCPS & PostCPS	27	.539	.002
Pair 6	Pre_pulse & Post_pulse	29	.489	.004
Pair 7	Pre_PRN & Post_PRN	29	.253	.092

Note. N= sample

The processes used in the study were based on Donabedian's framework of quality healthcare, which includes structure, process, and outcome (Donabedian, 1966, 1998). The outcomes for the participants in this study could be related to change in knowledge, behavior, health status, or practice of micro-practices that helped nurses focus on health-related quality of life (Ameh et al., 2017; Oostendorp et al., 2020; Zidarov et al., 2016). The fundamental causes of the changes experienced by the participants are beyond the scope of this pilot study. However, based on responses from nurses (see Table 5.3), this study somehow affected the nurses who are a "vehicle through which technical care is implemented" (Donabedian, 1988, p. 1744).

Online Intervention

Based upon a literature search, this is the first national fully online intervention examining nurses' chronic pain and stress outcomes. Online intervention and smartphone

app-based use is growing in popularity and have evidenced-based effectiveness with non-clinical and clinical populations (Cavanagh et al., 2018). The online intervention allowed our participants constant availability and flexibility to practice their intervention on their terms (Coster et al., 2020; Finlay-Jones et al., 2015). Providing an anonymous double-blind study was an advantage in recruiting participants (Polit & Beck, 2020). The online format was also cost-effective, making it suitable for a larger parent INDIRA trial. The survey instrument implementation through REDCap was intuitive. Each week the nurses received a survey as a link which they could access in their electronic mail from any mobile device. This survey link would take them to the secure REDCap site, where they could either listen to their intervention or upload their weekly/survey data. The retention rate of 80% indicated that the online intervention was acceptable to the participants.

Online Recruitment

After receiving Institutional Review Board approval, we placed the invitational link to the study on Facebook groups, Twitter, and LinkedIn and used email outreach. The nursing support groups in the Kansas City metropolitan area are large and actively participate daily on these platforms. The online groups allowed for the recruitment of a large and diverse sample of nurses. It is known that older participants, who would not participate on other social media sites such as Snapchat, TikTok, and Instagram, do join on Facebook (Kosinski et al., 2015). Using social media platforms, a sample size of 80 was initially achieved.

Attrition

After mailing the cortisol tests, the attrition rate was four, as the nurses stated they did not realize the study called for daily practice. These four participants did not fill out the

pre-study survey and were denied access to either intervention. In week one, the intervention was provided to 36 participants (LKM [n = 18] and ACG [n = 18]). After the first week, two participants from the LKM group withdrew due to work commitments. In contrast, six other participants did not participate after the second week and were nonresponsive to email outreach efforts. This rendered the total number in LKM (n = 14) and ACG (n =15), resulting in a full sample of 29 participants at the end of the study.

The sample size needed for this pilot study was 23, based on 10% of the sample size of 230 for the larger parent INDIRA study (Connelly, 2008; Lackey & Wingate, 1998; Treece & Treece, 1982). In feasibility studies, the attrition rates were high as 41% (Carson et al., 2005) and as low as 0% (Wathugala et al., 2019). New and varied content was provided each week, and the length of the study intervention was set to three weeks. To combat potential attrition, prompt email responses were programmed into REDCap, and the time required to complete questionnaires was kept under five minutes per Qualtrics time check matrix. As a token of appreciation for participants, they received not only pre- and post-serum cortisol results for free, but also a gift of downloaded meditation music that was created especially for this study by Jason Barrett. By paying attention to these engagement strategies, the INDIRA pilot study's attrition rate of 20%, is considered to be above average for MIB of 50% (Costner et al., 2020; Galante et al., 2014; Lam et al., 2015; Ramos et al., 2022).

In online meditation studies, attrition rates can be as high as 60%, and in online self-help interventions, the attrition rate can reach 50% in the nonclinical population (Cavanagh et al., 2018). In another online meditation feasibility study conducted to evaluate enhancing

nurses' compassion in a United Kingdom university, the post-intervention attrition rate was 53.2%, and at follow-up at 20 weeks was 59.7% (Costner et al., 2020). In contrast, at the University of Massachusetts in Boston, Pagán-Ortiz & Cortés (2020) reported no attrition for their three-month online health intervention feasibility for Latinas who suffered from CP. However, the instructions of this study were conducted in person for two hours with small groups, and each participant was given $20 cash for attending the pre-study session (Pagán-Ortiz & Cortés, 2020). In a similar online seven-day intervention with five-minute meditation practices for psychology students and interns in Chicago, the attrition rate was 50%, with 61 participants starting the study and 30 participants remaining at the end of the study (Costner et al., 2020; Lam et al., 2015). In contrast, in a university hospital-based, in-person mindfulness study in Ireland with 90 nurses, the attrition rate was 71% (Mahon et al., 2017). Systematic and meta-analyses do not report retention rates of the meditation-based studies they reviewed (Chiesa & Serretti, 2010; Guillaumie et al., 2017; Hilton et al., 2015). Nevertheless, a meta-analysis of mindfulness-based interventions for chronic pain (Veehof et al., 2016) found that the attrition rate for RCT ranged from 26.7% to 67.3%. Based on this literature, the retention rate for this online meditation-based pilot INDIRA study was above average (Costner et al., 2020; Veehof et al., 2016).

Measures

The short surveys, the numerical pain scale (NPS), The Perceived Stress Scale-10 (PSS), Serum Cortisol Levels, Self-Compassion Scale–Short Form (SCS), and Caring Factor Survey–Care Provider Version (CFS-CPV) took less than five minutes per Qualtrics analytics. All 36 participants completed the pre-study surveys. Weekly surveys uploaded

respectively were as follows. The LKM group (week one, n = 12, week two, n =14, week three, n = 12); ACG (week one, n = 15, week two, n =15, week three, n = 14). Post-surveys participation was NPS (n = 26), PSS (n = 27), SCS (n = 28), CPV, n = 27), and cortisol (n = 24), micro practices (n = 29), post-pulse (n = 29), and PRN (29). Overall, there was an 80% participation rate, indicating that the online assessments were acceptable to participants. To improve the return of the cortisol results, future research projects could use a local lab that allows the researcher direct access, with participant approval, to participants' results to reduce the burden of participants having to log in with their unique identification numbers (Nelson, 2015).

ANCOVA Results

The effects of the intervention were analyzed through ANCOVA. The confounding variable of pre-study NPS was used as a covariate to control for the effects of the intervention on the outcomes. Methodological control was in place through inclusion and exclusion criteria to ensure that both groups had a chance of equal distribution of data. The results of the ANCOVA output, as presented in Chapter 4, demonstrated that according to the fitted model, there was no relationship between the predictors of intervention and pre-NPS on study outcomes of pain (p = .803), stress (p = .154), self-compassion (p = .526), caring factor (p = .656), serum cortisol (p = .917), pulse (p = .117), or the need for over-the-counter pain medication (p = .529). Table 5.3 and Table 5.4 display a visualization of the results for ANCOVA and ordinal Logistic Regression (OLR).

Table 5.3

ANCOVA Output

Dependent Variable	F	*p*	η^2
Post-NPS	0.063	.803	.003
Post-PSS	2.166	.154	.083
Post-SCS	.414	.526	.016
Post-CFS-CPV	.203	.656	.008
Post-Cortisol	.011	.917	.001

Note. F= Critical value. p = Significance value. η^2 = Eta Squared. Post-NPS = Numerical Pain Scale. Post-PSS = Perceived Stress Scale. Post-SCS = Self-Compassion Scale. Post-CFS-CPV = Caring Factor Survey–Care Provider Version. Post-Cortisol = Post-study Cortisol Results.

Table 5.4

OLR for Post-pulse and Post-PRN Results

Dependent Variable	R^2_N	X^2	df	*p*
Post-Pulse	.0805	4.29	2	.117
Post-PRN	0.0215	1.27	2	0.529

Note. Post-Pulse = post-study pulse rate. R2N = Nagelkerke R Squared. df= degrees of freedom. *p* = significance value. The dependent variable "Pulse–last" has the following order: 50 to 60 beats per minute | 60 to 70 beats per minute | 70 to 80 beats per minute | Over 80 beats per minute. *Note*. Post-PRN = As-needed over-the-counter pain medication. dependent variable 'post-PRN' has the following order: Never | Rarely | Sometimes | Often | Always.

These results could be due to the small sample size, which can mask results and provide a non-significant correlation (Kellar & Kelvin, 2013). Therefore, the results can not be generalized to the broader nursing population. Conversely, in a systematic review and meta-analysis of 22 RCTs with 1,740 participants, interventions based on compassion

meditations found a decrease in pain, anxiety, stress, and depression and an increase in well-being (Galante et al., 2014). However, these results were based on a long-term intervention of eight weeks with 2-hour weekly sessions and practice of 30 minutes per day for two weeks (Galante et al., 2014). Similarly, a systematic review and metanalysis of 24 LKM research studies with (n = 1,750) that reported positive self-focused emotions across all analyses were conducted for three to eight weeks with up to two hours of practice per week (Zeng et al., 2015). In this pilot study, 29 participants self-reported engaging in micro-practices at least once every five hours.

Dr. Watson encourages nurses to apply the principles of Caring Science in their daily lives. This self-experience then allows the individual to use all ten Caritas Processes in all caring situations, including with self, colleagues, and patients' families, in an authentic manner (Brewer & Watson, 2015). Based on Dr. Watson's teachings, the INDIRA pilot study invited participants to practice their intervention with their whole person (Brewer & Watson, 2015; Pajnkihar et al., 2017). Therefore, participants were provided with an image that would remind them to practice with their brain, gut, and muscles to experience brief moments of caring for themselves. Other studies have found that micro-practices of consciously taking three deep nourishing breaths or stretching every few minutes while completely relaxing the body tension have significantly reduced pain, stress, anxiety, and compassion fatigue in nurses (Sitzman & Craven, 2021; Villafañe et al., 2020). As an example, a participant reported that she had worked 12-hour shifts straight for several days and had started intense physical therapy for an injury due to a car crash. She reported that Dr. Watson's daily meditation was extremely helpful and helped her to be mindful and take deep breaths. By

doing deep breathing and being mindful of her purpose, she reported that her pain and her stress levels were “better than expected.” For a complete list of responses to date, see Table 5.3.

Implications for Participants

A vast amount of research provides evidence of the effectiveness of meditation-based intervention (Hilton et al., 2017; Martinez-Calderon et al., 2019; Neff et al., 2020; Shonin et al., 2015). However, in a survey of 423 nurses conducted in the Midwestern region of the United States, 75% reported lack of time as a factor in not practicing self-care. Traditional meditation practices take 15 minutes to one hour per day (Avvenuti et al., 2019; Bansal et al., 2016). Many nurses indicated that they did not have time for traditional meditation practice. The micro-practices conducted in the INDIRA pilot study provided an alternative opportunity to practice meditation. One participant shared, “in the midst of our hurried and harried moments offers a choice point and mindful awareness of the present moment.” While this comes from one participant, the statement supports the idea that micro-practices can make a difference for individuals when they are used as directed. The implication for nurses is that they would consider trying consistent micro-practices to experience the benefits of reduction in pain, stress, anxiety, reduced cortisol, and mental well-being based on the following narrative feedback from the nursing participants.

Narrative Feedback

Although not indicated by ANCOVA results, participants did experience and report positive improvements. For example, one participant self-reported experiencing lifelong anxiety. She reported that this study helped her with deep breathing and that the “guided

meditation greatly improved my overall mental health." This is in keeping with findings in the literature that mindfulness-based intervention improved overall mental health (Hilton et., 2015; van Agteren et al., 2021; Veehof et al., 2016. According to Zeidan and Vago (2016), brief mental training affects cognitive changes that allow a person to "re-perceive" and have better control of the pain sensation. Being able to manage pain allows better coping and results in improved mental well-being (van Agteren et al., 2021).

Another participant emphasized this point by stating, "Just by pausing and engaging in lovingkindness meditations and gratitude through breath work in the midst of our hurried and harried moments offers a choice point and mindful awareness of the present moment." Even a skeptical participant reported that she found the practices "very helpful." These comments, one from a nurse who seemed familiar with the loving kindness practice and the other who seemed new to this work, represented the beneficial effects of regular micro-practices taught by Dr. Watson for nurses' well-being (Watson, 2005). Practicing self-care through micro-practices can allow nurses to engage in acts that provide greater access to their enhanced authentic presence (Griffin et al., 2021). Consistent, brief practice can act as mental training to increase cognition and promote emotional, physical, and spiritual wellness by decreasing fear, anxiety, depression, stress, and pain (Deng et al., 2019; Zeidan & Vago, 2016).

One participant reported, "My pain and stress level has been better than expected given all that's been on my plate." As Abdallah and Geha (2017) pointed out, pain and stress are two sides of the same coin, as they involve responses of the limbic system. The experience of stress heightens the inflammatory process, which promotes the pain (Zeidan &

Vago, 2016). However, this participant noted that mindfulness-based meditations could reduce stress and pain and additionally improve quality of life. It is known that these practices of mindfulness-based meditation are known to influence the limbic system, which results in both stress and pain reduction (Adler-Neal & Zeidan, 2017; Lazar et al., 2005). In addition, meditative practices have also been shown to increase focus, clarity, and mood and improve the quality of sleep (Innes et al., 2018). These consequences of meditative micro practices were highlighted by a nurse who reported that even with "little sleep" and a "chaotic" life, she had noted improvement in her mental health. She was able to "focus better."

Moreover, studies show that consistent meditative practices can activate the practice reward centers in the brain, decrease cortisol levels, increase well-being, and make changes in the brain. Loving kindness actions based on Caring Science demonstrated that consistent self-care could reduce stress and increase self-compassion, as reflected in cortisol biomarkers (Nelson, 2015). Caring actions seemed to change behaviors that positively impacted mental well-being (van Agteren et al., 2021). Four participants wrote about feeling "relaxed," which, according to self-reports, were reflected in their serum cortisol levels. One of the first participants sent a note stating, "My results were normal, and I attribute it to the meditation and self-care micro-practices." The second participant said that he had a "really stressful week leading into yesterday and thought my results would be higher than my baseline, but I was very surprised to learn it came back at less than half." A third participant noted with amazement, "Oh my word Jo my cortisol levels went from 14 to 3."

In contrast, a participant wrote to apologize that she did not have an opportunity to practice, and her levels were higher than expected. This participant reported she had difficulty at work and was traveling to visit with her son, who is in the military. Due to the double-blind procedure, we can not directly correlate this participant's cortisol levels. However, for one participant, there was a substantial jump in serum cortisol from 6.8 to 30.2. If we could link these results to the participant who sent the email regarding her high stress levels, it would demonstrate that stress does trigger the hypothalamic-pituitary-adrenal axis that is reflected in serum cortisol levels (Dahan et al., 2014; Karhula et al., 2016; Matousek et al., 2010; Timmers et al., 2019). The unattended stress in everyday activities can elevate cortisol levels even after the stressful event has subsided (Fischer et al., 2000). These four participants' statements reflect that cortisol levels are valid markers of stressors faced by healthcare workers (Barker et al., 2005; Fernández-Sánchez et al., 2018; Fischer et al., 2000; Matousek et al., 2010). The nurses who had time to practice self-care reported lower-than-expected cortisol results. The one nurse who had a stressful week reported higher than expected cortisol results. The last email received to date was from a participant a month after the study concluded. She stated, "I am not one to use meditation or relaxation techniques." However, she regularly practiced the techniques offered and reported, "I continue to use them as needed, and I have found they do relax me. Thank you." This one response shows that a month after the study concluded, the intervention seemed to help this nurse, indicating beneficial effects for this one nurse. Similar results were found in other meditation-based studies conducted with nurses (Lopes et al., 2019; Mahon et al., 2017). Zeidan et al. (2011)

showed through functional magnetic resonance imaging that mindfulness-based meditations do improve one's mood and pain ratings.

As demonstrated by nurse comments and as noted in Chapter 2, the reason for reduced chronic pain, stress, anxiety, and serum cortisol results could be attributed to neuroplasticity as an effect of meditation practices on the person's pre-frontal cortex, orbitofrontal cortex, and the limbic system (Hölzel et al., 2011; Tang et al., 2015; Timmers et al., 2019). The self-reports by nurses reflect what is present in the literature, that even brief periods of meditation were effective in reducing pain, stress, overall mental health, and serum cortisol (Apkarian et al., 2005; Awasthi, 2013; Bottaccioli et al., 2014; Tang et al., 2015; Wu et al., 2019; Zeidan et al., 2011, 2016).

Implications for Future Research

The ease of online intervention for both researchers and participants encourages the utility of this study for future research. This research found that Facebook groups provide a rich sampling site (Kosinski et al., 2015). It was found that group creators were eager for their group members to participate in this study. Participants were gathered from all over the U.S. using social media, especially Facebook, as a recruitment tool. Most participants filled out pre- and post-surveys, indicating that participants found the measures manageable (Cavanagh et al., 2018). Although daily participation logs were essential to verify participation and intervention fidelity (Eaton et al., 2011; Santacroce et al., 2004), the lack of responses in these surveys shows that perhaps asking multiple questions each day was cumbersome to the participants. Asking nurses to keep a log of daily participation and asking them to upload it at the end of the study may have yielded more returned surveys. Most

importantly, from the responses we received, the study had the benefit of helping nurses manage pain, stress, anxiety, sleep, and cortisol levels.

Although self-reports of this study were positive, the ANCOVA fitted model did not find significant results. That means these self-reports can not be attributed to the intervention steps. These changes could be due to the placebo effect, where the results cannot be linked with statistical significance to the intervention (Oostendor et al., 2020). The placebo results could be because of expectations or nonspecific aspects of the intervention or patients' belief in the treatment (Oostendor et al., 2020). A white paper on chronic pain by the Institute of Medicine (IOM, 2011) stated that factors that affect pain control include anticipation, attention, empathy, reward, and the placebo effect. This study may have evoked psych-neurobiological changes that are found to reduce subjective pain symptoms (Colloca, 2019). Therefore, a direct link to this intervention can not be made based on this limited study.

Limitations

Two significant limitations of this pilot study were the small sample size of 29 participants and the double-blind procedure. Although the sample allowed us to test the feasibility of the study, the sample size did not provide statistical power for generalization. The double-blind procedure made it difficult for the researcher to monitor or contact the groups. One issue encountered was of understanding the communication preferences of the participants. As the participants were double-blinded to the researcher, it became difficult to reach the six participants who needed to be more responsive to email outreach. One alternative would be to conduct this study with a known sample to provide accessible communication (Lam et al., 2015). A second alternative would be to obtain a verbal

understanding of the procedures from the participants and their preference for communication (White-Lewis et al., 2019). A third alternative would be to use the participant's preference for communication to provide prompt resolutions of any issues that might be encountered by the participant or researcher (White-Lewis et al., 2019).

Other limitations of this study are the reliance on self-reported data and the absence of a longer-term follow-up. A follow-up survey is recommended as the long-term effects of an intervention can be noted in stress, pain, cortisol, caring, and self-compassion in the data collected three months post-study (Aguilar-Raab et al., 2021; Lopes et al., 2019). Self-reports are versatile and can provide information that is otherwise not easily gathered (Polit & Beck, 2020). However, since participants tend to share positive information about themselves, it might not represent the truth (Polit & Beck, 2020). A third limitation was not giving the participants a prescribed amount of time to engage in the micro-practices. On average, engagement in micro-practices was once every four to six hours. The latest research demonstrates that meditation is as effective as medicine for acute stress in samples with an acute generalized anxiety disorder; however, participants had to practice meditation for 45 minutes daily for six weeks (Hoge et al., 2022).

Conversely, a brief three-day, 20-minute mindfulness practice was found to be as effective in lowering blood pressure, heart rate, and pain measurements (Zeidan et al., 2010). Similarly, Lam et al. (2015) found that a seven-day, five-minute meditation was helpful for nurses. Therefore, we recommend that nurses practice every 30 minutes for one month. This can help nurses consciously decrease stress, increase self-compassion and mindfulness for themselves, and create a therapeutic environment for patients (Lam et al., 2015).

Suggestions for Further Study

It was feasible and acceptable for nurses to participate in the online asynchronous INDIRA pilot study. We encourage future researchers to conduct a similar survey with known participants. Identical to the model used by Pagán-Ortiz & Cortés (2020), we recommend having an in-person introductory seminar to explain the procedure in detail, obtain verbal understanding, and answer any questions that may arise. We recommend a larger sample size to provide adequate power for statistically significant results (Kellar & Kelvin, 2013). Additionally, using a local lab to process serum cortisol would give researchers access to the data that would reduce the participant's burden (Nelson et al., 2015). We recommend the use of alternative assessments, such as quality of life and quantitative data (Chang et al., 2016; Lopes et al., 2019). By prescribing micro-practices for 60 seconds every hour, nurses could accumulate 16 minutes or more of micro-practices per day. Most research studies have found that 15 minutes of practice per day can positively change one's neurobiology (Bauer et al., 2017; Cheng & Cheng, 2019; Donahue et al., 2021; Khoo et al., 2019; Polaski et al., 2019). Finally, we would use a single-blind assignment in which the participants are blinded, giving the researchers access to participation logs, and troubleshooting any issues that might come up while administering the intervention (White-Lewis, 2019).

Conclusion

Based on the theories of Adult Education and Donabedian's structure process and outcome model, this pilot study provided an online asynchronous three-week intervention, allowing participants the freedom to practice in their own space and at a time of their own

choosing. The theories of Positive Psychology, Caring Science, Self-compassion, and Neuroplasticity offered participants a weekly micro-practice to help reduce stress, chronic pain, serum cortisol, pulse rate, and medication intake and increase self-compassion and professional caring. The literature search revealed that globally chronic pain is prevalent. Unmanaged chronic pain and stress can negatively affect nurses' self-esteem, job satisfaction, and general well-being. A nurse reported that chronic pain "has made my world very small." Moreover, during the post-COVID-19 aftermath, 50% of nurses declared their intention to leave their jobs. Such a loss of dedicated nurses could become unsustainable for the profession, even as the tangible costs of chronic pain range in the billions of dollars; the intangible costs of losing nurses' talent, passion, and knowledge are immeasurable. Although managerial support and systematic changes are critical to support nurses' well-being, responses to daily pain and stress remain an individual's responsibility.

This dissertation presented the history of meditations dating back to ancient times to the most recently published literature. The literature presented in this study shows that meditation-based interventions can positively affect an individual's mental, physical, and emotional well-being through pain and stress control. The researcher found these effects in studies that lasted for three days, one week, one month, and three months. Both short practices of five minutes and longer practices of one hour are effective. Meditations can be practiced in a formal setting or informal settings like micropractices. Although no link can be made between the INDIRA pilot intervention and the results based on the ANCOVA model, pre-test and post-test analysis showed significance in all categories except the need for pain medication. The unknown participants' self-reporting added validity to the effect that has yet

to be identified. This INDIRA pilot study has provided a direction for future research. Consistent micro-practices could lead to positive changes in neurobiology and positively affect proximal outcomes of pain, stress, serum cortisol, self-compassion, caring factor, pulse rate, and need for over-the-counter pain medication, with distal consequences of nurse retention and increase in patient satisfaction.

APPENDIX A

UNIVERSITY OF MISSOURI-KANSAS CITY FACILITIES OF SUPPORT

The University of Missouri-Kansas City (UMKC) is part of a four-campus University of Missouri System, public research and doctoral-level institution established in1929. UMKC has a diverse enrollment, with approximately 40% of students identifying as mixed-race, international, or minority groups. UMKC has an academic health center, the Schools of Nursing and Health Studies, Medicine, Pharmacy, and Dentistry on a campus known as Hospital Hill. The University of Missouri encourages all faculty and staff to pursue research and scholarly inquiries. The Office of the Vice Provost for Research oversees and promotes the core aim of research to all its campuses and has experience supporting small and large, long-term intervention studies.

University of Missouri Libraries

Students and staff have access to the University of Missouri MOspace Institutional Repository; MU Digital Library MOBIUS gives students access to 11 million items. The three libraries at the University of Missouri are St. Louis's Thomas Jefferson Library, St. Louis Mercantile Library, and Curtis Laws Wilson Library. The University of Missouri Columbia's Ellis Library caters to all disciplines, from engineering to veterinary medicine. The Missouri UMKC has three libraries: Miller Nichols Library, the Health Sciences Library, and UMKC Law Library, with over 70 digital databases such as Medline and CINAHL, among others. The UMKC librarians provide exceptional, instant support to students 24-hour, all year round, through a chat box, and video support is provided Monday through Friday, nine in the morning to five in the evening. Students can make appointments with the librarians specializing in their field of research. During lockdown, the librarians are an invaluable source of support to student researchers.

UMKC Technology Support

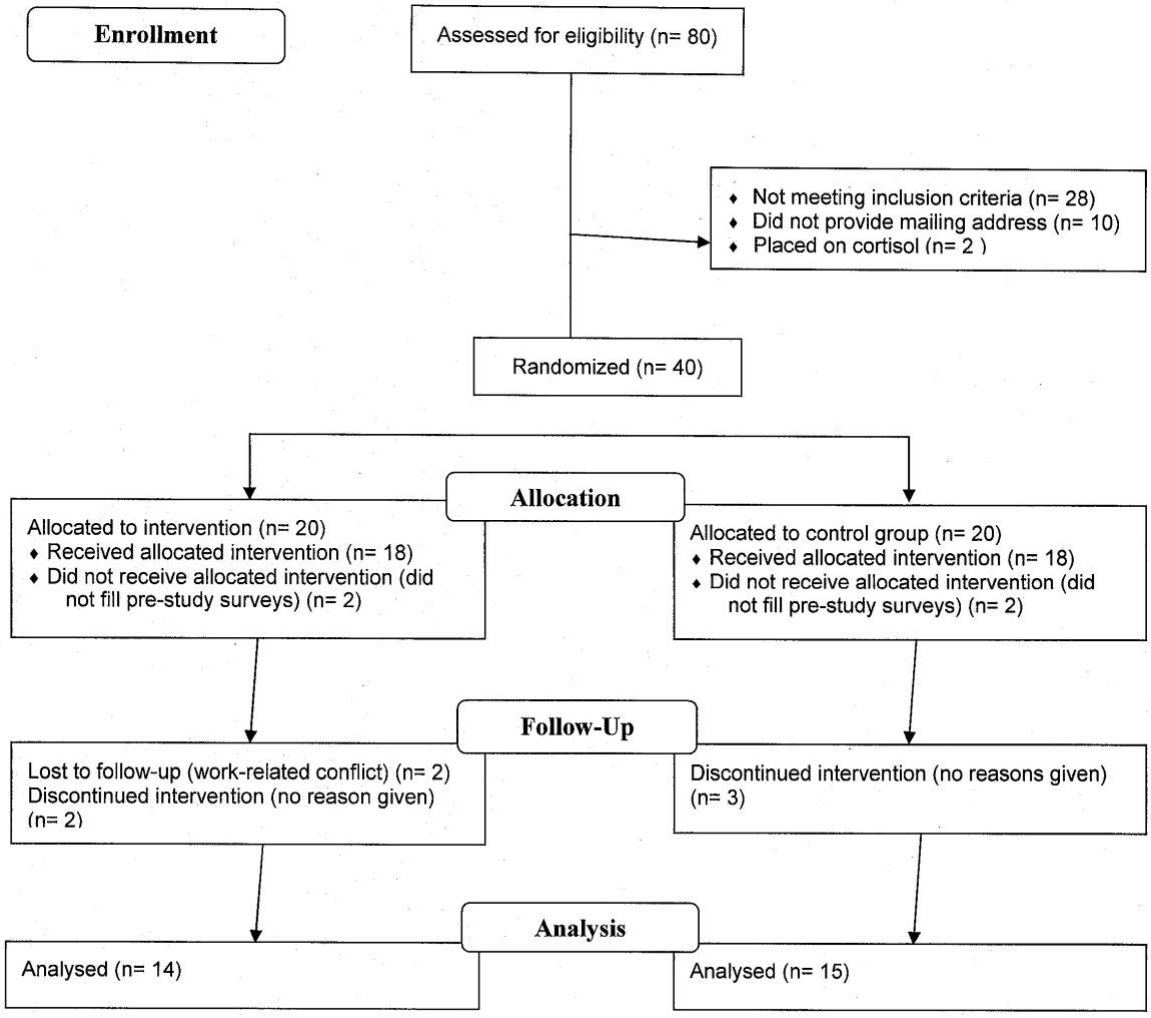
UMKC's technology center provides 24-hour help with email and CANVAS issues. Students are also provided free around-the-clock access to HIPAA-compliant, encrypted, and secure services of REDCap and Qualtrics databases, which are web-based, metadata-driven software solutions for research. These databases accommodate the personal needs of each study and allow researchers to customize their instruments and data collection to provide maximum rigor. REDCap also provides results as simple percentages that can be displayed as graphs. The students have access to a REDCap support team member that guides the research team throughout the project.

UMKC School of Nursing (SON)

The UMKC School of Nursing (SON) and Health Studies is dedicated to its diverse student body and supports its endeavors to discover best practices in all nursing fields. UMKC SON faculty are student-centered, research-focused, and committed to creating confident future nurses and curious scientists who will advance nursing knowledge. The SON receives funding from R01s, R03s, R15s, R21s, and R29s, private foundations, federal, state, and city grants, and external and internal funding sources that support the research mission of the school. The faculty support guided this study to produce evidence-based therapy for nurses with chronic pain. These results will empower nursing systems to implement high-quality, cost-effective, nurse-led meditation-based interventions that can enhance the ability of all clinical and non-clinical persons to manage their chronic pain. The SON's support of this research will effect change in the healthcare environment. The UMKC SON faculty guided this study from a conceptual idea to the final product, offering a weekly iterative process to refine this research design. With a classroom-based format, the SON provided a faculty and peer support community, allowing this study to present at the American Holistic Nurses' annual conference. The SON faculty served as nurse research mentors who gave this study-specific feedback and encouraged the pursuit of grants and scholarships. Because of their encouragement, this study was awarded $1,800 by the Women's Council Graduate Students Funds Award.

APPENDIX B

CONSORT FLOW DIAGRAM



Source: Rennie (2001).

APPENDIX C

WEEKLY PARTICIPATION SURVEY

Weekly Participation Survey

Compassionate self-care provides a critical foundation that enables me to authentically offer care for others (Sitzman & Watson, 2018).

Days	**When awake I performed micro self-care** 1 = At least once every hour 2 = At least once every 2 hours 3 = At least once every 4 hours 4 = At least once every 6 hours 5 = At least once every 12 hours 6 = At least once a day 7 = Did not practice	**My radial pulse rate was beats/min** 1= Less than 50 2 = 50 to 60 beats per minute 3 = 60 to 70 beats per minute 4 = 70 to 80 beats per minute 5 = Over 80 beats per minute	**I needed PRN medications to manage my pain** 1 = Never 2 = Rarely 3 = Sometimes 4 = Often 5 = Always
Sunday			
Monday			
Tuesday			
Wednesday			
Thursday			
Friday			
Saturday			

Please print or keep this fillable table to track your daily data points. You will be requested to input this data each week. Thank you for your consistent participation.

APPENDIX D

LKM WEEK 1 INSTRUCTIONS

Dear Nursing Colleague,

Welcome to week 1! We are excited that you are a part of this study. For week 1, please download the guided music by Dr. Jean Watson to your devices or listen to it online as many times as you like. This short 7-minute audio by Dr. Jean Watson helps us connect with our initial dream of becoming a nurse, called the Caring Moment at: https://www.youtube.com/watch?v=CI81_FAVtqk.

The micro-practice of this week is called Serenity Pause®.

Serenity Pause (Nima Taylor)

Just sit/stand, just breathe (inhaling deeply, exhaling completely), just be, and fully experience total Serenity.

Please practice the compassionate micro-practices with your whole being (mind, heart, gut & muscle) throughout the day, as many times as you like.

Tips for practicing
Before entering the patients' room.
After documenting care.
Before speaking to a patient.
After doing a dressing change.
At a red light.
In an elevator.

Before you sleep daily, bring to mind images of the micro-moments of total Serenity you experienced today. Allow these images to fill you with loving kindness and gratitude.

You create caring moments for self & others!

Please fill out the daily participation survey attached and upload it on Sunday. If you need more time to submit it, please let us know what day works best for you. If you have trouble uploading the document, please email us. Surveys are essential as they provide meaningful data.

All the best!
Jo Valluri Ph.D. (c), MS Ed, BSN, RN
Jvz39@umsystem.edu
For the INDIRA study team.

APPENDIX E

ACG WEEK 1 INSTRUCTIONS

Dear Nursing Colleague,

Welcome to week 1. This week, please view this video by Carolyn Jones, *A Tribute to Nurses* at: https://www.youtube.com/watch?v=urOCG-MlB9g. Carolyn reminds us that our words and actions make a difference to our patients. Please download the video and watch it throughout the week.

The micro practice of this week is Receiving Gratitude.

Receiving Gratitude

Take brief, quick, moments to fully acknowledge when someone is expressing gratitude to you.

Please practice the compassionate micro-practices with your whole being (mind, heart, gut & muscle) throughout the day as many times as you like.

Tips for practicing

Anytime a patient or family member thanks you.
When you give someone their medication.
When you give them a glass of water.
When you make them feel comfortable.
When a colleague thanks you.
When a stranger smiles at you.

Before you sleep daily, please bring to mind all the people that expressed their gratitude.

You make a difference each day!

Please complete the daily log, as this will help us understand the impact of these micro-practices over the 3 weeks of the study! If you have trouble uploading the document, please email us. Surveys are important as they provide important data.

All the best!
Jo Valluri PhD (c), MS Ed, BSN, RN
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For the INDIRA study team.

APPENDIX F

ALL SELF-REPORTS FROM PARTICIPANTS

"My results were normal, and I attribute it to the meditation and self-care micro-practices. Thank you for allowing me the opportunity to be a part of your study."
"I had a really stressful week leading into yesterday and thought my results would higher than my baseline, but I was very surprised to learn it came back at less than half."
"Oh my word Jo! My level went from 14 to 3!!!!"
Unfortunately, my results are higher than the first one, also under more stress that week as it was a busy week in the nurse's office and was preparing for a family weekend trip to Colorado over Labor Day weekend…"
"I am a married mother of 4. I am a hospice nurse and completing my last semester of a Family Nurse Practitioner degree. My life is pure chaos each day, I live off of 5-6 hrs max of sleep each night. In addition, I have battled anxiety since childhood. Holistic and alternative practices are where my heart has always been but finding the time to implement them effective throughout the day has been a struggle. This study helped with the deep breathing and the guided meditation greatly improved my overall mental health. It reminded me that there is a purpose to all of the chaos in my life. The tough moments are a bit easier to manage with forcing myself to slow down, deep breath, be present in each moment and remind myself that I am exactly where I am supposed to be. Thank you for the experience!"
"This week I've needed the calmness. The deep breathing and being mindful has helped push me through. I did 12 days straight of work and clinic, in addition, started more intense PT (fracture spine from car wreck in March). My pain and stress level has been better than expected given all that's been on my plate. Managing and reminding myself like the first recording stated that this is my journey and there is a purpose. Just wanted to give you an update. Thanks!"
"Just by pausing and engaging in lovingkindness meditations and gratitude through breath work in the midst of our hurried and harried moments offers a choice point and mindful awareness of the present moment."
"I actually found it very useful, and I was initially highly skeptical. Thank you."
"I am not one to use meditation or relaxation techniques however, during your study I used the techniques offered each week. I continue to use them as needed and I have found they do relax me. Thank you."

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VITA

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Mrs. Valluri entered the University of Missouri at Kansas City Nursing Ph.D. program with a passion for understanding how meditation impacts chronic pain outcomes in nurses. She is passionate about helping nurses reduce chronic pain and stress and fulfill their dream of providing compassionate nursing care. Upon completion of the Doctor of Philosophy degree, Mrs. Valluri plans to continue teaching traditional and non-traditional students and continue her research and consulting.