

A DNP PROJECT

The Use of HeartMath Technology as a Quality Improvement Intervention to Reduce Perceived Stress Levels in Pre-licensure Nursing Students to Improve Outcomes

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Dedication

This project is dedicated to all the nurses and nursing students who have given a large portion of their life in helping people and have sometimes compromised their own mental health as a result of such a high stress job. This project is to show that making sure we are all mentally and emotionally healthy is just as important as physical health.

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ABSTRACT

Introduction: The mental health of nursing students and nurses is becoming an important national conversation. The AACN has put out a Call to Action that states that undergraduate nursing programs need to incorporate well-being and mindfulness into all nursing curricula. High stress and anxiety levels are often reported among undergraduate nursing students. Nursing students experience stress during their education due to academic stress in addition to stress experienced during clinical. High levels of stress can lead to poor academic performance as well as not being able to adapt and cope to the stressors of the nursing profession.

Methods: This study evaluated the effectiveness of the biofeedback technique, HeartMath, in reducing prelicensure nursing students perceived stress levels. Participants were recruited from a pre-licensure nursing program. The intervention includes each participant receiving HeartMath's Inner Balance device to use daily, along with participating in an online Blackboard course.

Along with perceived stress levels, adherence to the technique was also be evaluated

Results: Although the aim of an overall 20% improvement in perceived stress scores among the group was not achieved, there was an overall improvement of 11.9%. The adherence rate of each participant practicing three or more days a week was not achieved.

Conclusions: Although limitations existed and specific aims were not met, the study suggests that HeartMath can be an effective technique in reducing nursing students perceived stress levels.

Keywords: biofeedback and/or therapy, HeartMath, heart rate variability (HRV), mental health, mindfulness, nursing, nursing students, perceived stress, stress, stress reduction, undergraduate nursing students

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The Use of HeartMath Technology as a Quality Improvement Intervention to Reduce Perceived Stress Levels in Pre-licensure Nursing Students to Improve Outcomes

High levels of stress and anxiety are on the rise in college students (American Institute of Stress, 2020). Stress is the physiologic response that has (a) emotional, (b) social, (c) behavioral, and (d) cognitive effects (Pulido-Criollo et al., 2018). Although some stress is necessary in order to stimulate and motivate students, a high-level causes anxiety and is associated with a decrease in ability to concentrate and focus. Undergraduate nursing students tend to have a high level of anxiety and stress than the average college student due to the heavy workload and clinical stressors (Turner & McCarthy, 2017). A systematic assessment and meta-analysis of nursing students from 15 countries worldwide found that 34% of participants experienced depression, and that depression was typically accompanied by other mental health diagnoses like anxiety (Chen et al., 2020). The unhealthy psychological state that a nursing student develops in school can not only impact their academic performance but also lead to the loss of love for nursing and burnout or high attrition rate as a nurse (Guillaumie et al., 2017). Because of this, nursing educators have started to incorporate ways to reduce stress and anxiety in students of education programs. The American Association of Colleges of Nursing has announced that the deans of the nation's baccalaureate and graduate nursing programs have begun an initiative called A Call to Action for Academic Nurse Leaders to Promote Practices to Enhance Optimal Well-being, Resilience, and Suicide Prevention in U.S. Schools of Nursing (AACN, 2021). This action emphasizes the importance of nursing programs to move from a state of "crisis intervention to prevention" by providing resources, screenings, programs and support for nursing students to promote stress management and prevent depression and anxiety (AACN, 2020).

Further, we have seen mental health issues rise among COVID-19. Not only does the coverage of the virus cause distress and anxiety among the general population, but quarantine can lead to (a) loneliness, (b) grief, (c) anxiety, and (d) chronic stress, all of which have long-term psychological impacts (Banerjee, 2020). In addition, nursing schools worldwide have had to interrupt their education and many clinicals have been discontinued to protect students from COVID-19 and reduce the risk of spreading the virus. Clinicals provide much hands-on training for nursing students and students learn many skills necessary to be a nurse at these sites. Having to discontinue such learning has led nursing students to feel inadequate as a nurse upon graduation. Inadequacy in skills and performance, in addition to stress from COVID-19 infection and lack of preventive measures has increased the stress and anxiety of undergraduate nursing students tremendously (Quidley-Rodriguez et al., 2022). The nursing profession is one of high stress and historically plagued with burnout. If nursing students are not equipped with the skills necessary to cope with stress and anxiety, the result will not only be poor academic performance in school but also the inability to adapt and cope to the stressors of the profession, leading to poor mental health outcomes.

Background

Stress is the reaction to any challenging and adverse event and requires an individual to act or adapt through any physical, emotional, mental, or psychological reaction. Unhealthy responses to stress can lead to serious health issues, such as (a) anxiety, (b) depression, and (c) physiological complaints like headaches and abdominal pain, all of which impact a student's ability to learn (Alghamdi et al., 2019). Nursing students are susceptible to several stressors due to the combination of challenging academic courses and clinical training (Alghamdi et al., 2019). Many pre-licensure nursing programs exist in the United States, ranging from the traditional

bachelor's program to accelerated 12- and 16-month programs. In comparison to traditional nursing programs, accelerated undergraduate nursing programs are for those students who have already obtained a bachelor's degree and are pursuing a second degree in nursing. Accelerated nursing programs were developed as a solution to the Institute of Medicine's goal of increasing the nursing workforce holding a BSN degree to 80% by 2020. Although these programs build on the previous learning experiences of the students and have shown to increase the number of bachelor-prepared nurses entering the workforce, the attrition rate of these programs remain remarkably high (Lott et al., 2018).

HeartMath is a biofeedback technology that uses the Inner Balance device to focuses on changing the heart rate pattern to create physiological coherence, which in turn increases emotional well-being. The Inner Balance device is a Bluetooth sensor that measures an individual's heart rate variability in real time. Physiological coherence is measured by an individual's heart rate variability and is defined when the individual's heart rhythm becomes more ordered and sine-wave like and refers to the pattern of the heart rate versus the speed (McCraty, 2022). HeartMath is an evidence-based technique that is used to develop resilience on a personal and professional level (Clark & Gorton, 2019). The technique involves the ability of changing your heart rhythm pattern through controlled breathing and positive emotions, reducing stress and anxiety. The HeartMath technique helps shift the rhythms of the heart and creates a more resilient baseline that can improve one's ability to recover from stressful situations and prevent unwanted stress reactions (HeartMath, 2021). Research done through the HeartMath institute reveals that stress and negative emotions cause the heart rhythm to become erratic, causing inhibition of high cognitive functions of the brain. This inhibition limits our memory, our ability to think clearly and reason, and reduces our ability to make sound decisions.

However, with controlled breathing and positive emotional states, the heart rhythm becomes more organized and stable. Heart focused breathing combined with positive emotional states causes a coherent heart rhythm that in turn allows for the maintenance of emotional and behavioral control and stability (McCraty, 2022).

General Problem

As stress and anxiety levels increase among undergraduate nursing students, solutions for coping with these issues are needed to promote health and well-being (Alghamdi et al., 2019). The American Association of Colleges of Nursing has implemented a Call to Action for academic nurse leaders. This call emphasizes the importance of promoting practices that enhance students' well-being into nursing schools across the U.S. (AACN, 2021). Undergraduate nursing programs should have the responsibility of ensuring students are geared with the coping strategies needed to prevent or reduce stress during their educational program and into their nursing career. Research suggests that biofeedback techniques like the HeartMath technology can be successful in reducing perceived stress levels in individuals (Low & McCraty, 2018). Evaluating its effectiveness on nursing students may further lead to a solution for treating rising stress levels in healthcare providers and nurses specifically.

Specific Problem

According to data from the Youth Risk Behavior Survey put out by the Florida Department of Education, students today are struggling with mental health issues more than they were 10 years ago. In 2019, 33.7% of teenagers survey reported feeling sad or hopeless, in comparison to 26% in 2009 (Florida Department of Education, 2022). In the 2019 Community Health Needs Assessment, it was found that mental health issues ranked as the most important and crucial health issue in Duval County (UF Health, 2019).

The AACN has stated in their Call to Action that undergraduate nursing programs should incorporate well-being and mindfulness in the nursing curriculum. Currently, the pre-licensure school of nursing does not incorporate a separate class or program to promote stress reduction techniques among the students. Qualitative student feedback regarding stress during the undergraduate program supports the need for evidence-based strategies to support student mental health.

Available Knowledge

Search Process

There is limited literature on biofeedback therapies specifically targeting undergraduate nursing students on stress reduction. However, much research exists on the high stress levels of nursing students. A review of literature was performed using the databases CINAHL and PubMed through the Jacksonville University online library. The searchable questions used to guide the review of literature was stress among undergraduate nursing students and biofeedback therapy as an effective source of stress reduction among undergraduate nursing students. The search terms used were *biofeedback* and/or *therapy*, *HeartMath*, *heart rate variability (HRV)*, *mental health*, *mindfulness*, *nursing*, *nursing students*, *perceived stress*, *stress*, *stress reduction*, and *undergraduate nursing students*. Inclusion criteria for the review were studies focused on stress among nursing students, effectiveness of biofeedback techniques in reducing stress levels, stress in nurses, and negative impacts of stress on students. Exclusion criteria included studies that focused on age groups less than 18 years and articles submitted prior to 2015. After a review and elimination process, 30 papers were selected to be a part of the literature review. The themes identified were: (a) prevalence of stress among undergraduate nursing students, (b) the negative effects of stress on students, (c) burnout among nurses, (d) benefits of biofeedback therapy on

reducing stress, and (e) the importance of incorporating stress reduction techniques into nursing education.

Review of the Literature

Stress Among Undergraduate Nursing Students

College-aged adults (18-25 years of age) are at the greatest risk for developing mental illness and have the highest prevalence of any type of mental illness of any age group (Seppala et al., 2020). The U.S. Census Bureau reported that over 18 million young adults were college students, and nearly 3 out of 4 of these students have experienced a sense of “overwhelming anxiety” at some point, and 30% of these students had experienced it in the last 2 weeks (American Institute of Stress, 2020). In college-aged adults, stress is many times triggered by social interactions and academic requirements (Pulido-Criollo et al., 2018). The American College Health Association reports that 45% of college students admitted to being so depressed it was difficult to function, that 66% reported an overwhelming feeling of anxiety, and 13.3% had seriously considered taking their life in the last 12 months (AACN, 2021). Over ¼th of mental health clinicians stated that anxiety is the top concern of their college student patients during the 2020-2021 school year (Statista Research Department, 2022).

It has been reported that nursing students experience higher levels of stress than students pursuing other degrees (Bartlett et al., 2016). Among college students, undergraduate nursing students face high levels of stress due to high academic workload and clinical stressors. Levels of stress and anxiety in nursing students are found to be higher in comparison to the general student body (Aloufi et al., 2021). Heavy academic course loads, stringent exams, pressure to maintain a (a) high GPA, (b) complex interpersonal relationships, (c) challenges in clinicals, (d) caring for the very ill, and sometimes balancing a job as well, results in great anxiety among nursing

students in comparison to other healthcare disciplines (Savitsky et al., 2020). A study involving 170 nursing students found that a third of participants met the criteria for being clinically depressed or anxious (Aloufi et al., 2021). Nursing students face the transitional pressures experienced by college students in addition to having to compete for entry into competitive nursing programs and then covering stringent didactic and clinical coursework simultaneously (Turner & McCarthy, 2017). Nursing students face stressors different than other healthcare students. Introduction to the clinical setting as an undergraduate student produces significant stressors including (a) feeling unprepared for practice, (b) fear of making a mistake, (c) witnessing pain and death, (d) constantly being observed and evaluated, (e) communicating with physicians, and (f) not being familiar with the hospital setting (Turnery & McCarthy, 2017). A cross-sectional study of 87 nursing students found that most nursing students' stress is related to a high academic load (Alghamdi et al., 2019). In addition to the stressors of clinical and academic demands, nursing students must deal with personal and financial stressors as well, and many nursing students tend to be non-traditional students with family stressors (Turner & McCarthy, 2017).

Under normal circumstances, stress and anxiety is highly prevalent among nursing students. However, with the COVID-19 outbreak starting in 2020, nursing students have encountered new stressors including (a) fear of infection, (b) challenges to distance learning, (c) lack of protective gear during clinicals, etc. In a study evaluating general anxiety among nursing students during COVID-19, nearly 43% scored as moderate anxiety, and 13% scored as severe anxiety (Savitsky et al., 2020).

Stress Negatively Impacts Students

The World Health Organization stated in 1996 that students must be emotionally healthy and secure in order to appropriately participate in education (Pascoe et al., 2019). Students who report that high levels of stress impede their academic performance are those who also report (a) lower GPAs, (b) lower coping self-efficacy, (c) resilience, and (d) social support (Frazier et al., 2019). The Organization for Economic Co-operation and Development conducted a survey involving 72 countries and 540,000 student respondents from secondary and tertiary educational institutions. The survey showed that more than half of the students report high levels of stress and anxiety, and that high levels of perceived stress is strongly associated with poorer levels of academic performance (Pascoe et al., 2019).

Alghamdi et al. (2019) found that the most common reported symptoms of stress were alterations in sleeping behaviors and eating behaviors, the inability to improve patients' health conditions, and then inability to answer patients or family's questions. Uncontrolled stressors can lead to sleep irregularities, and emotional disturbances, both of which can negatively impact the student's academic performance (Niknami et al., 2015). Stress and anxiety in undergraduate nursing students' effects (a) communication, (b) learning, (c) clinical practice, and (d) overall academic performance. This can cause poor-quality patient care for the nursing student, leading to consequences for the patient (Aloufi et al., 2021). Stress is considered a barrier to learning, and causes (a) poor concentration, (b) decision making, and (c) interferes with other abilities necessary for a student to learn (Rathnayake & Ekanayaka, 2016).

Stress can have long term effects such as the development of anxiety and/or depression, but also short terms effects such as reduced learning capabilities (Pulido-Criollo et al., 2018). The physiological symptoms of stress and how it impacts a student not only varies on the

duration and intensity of the stressor, but also on the coping mechanisms of the student and resources available. The effects of stress can vary from the development of (a) psychiatric disorders, (b) sleep disorders, and (c) alcohol and substance abuse to negatively impacting academic performance and social relationships. About 55% of college students report either (a) depressive symptoms, (b) burnout, and/or (c) increased use of alcohol and about 42% develop a mental health disorder during their time as a student. Further, about 75-90% of healthcare students, including nursing, increase alcohol or tobacco use, particularly during their last year as a student (Pulido-Criollo et al., 2018). Factors reported that contribute to this increase in substance use is the difficulty of the (a) educational program, (b) stress, (c) environmental factors, (d) social acceptance, and (e) availability of alcohol (Pulido-Criollo et al., 2018).

Burnout of Nurses

Job burnout has become an increasingly more discussed phenomenon over the recent years. The mental health of nursing students' effects how they will cope and handle the stressors of the nursing profession. Anxiety and stress in nursing students ultimately impact burnout and high turnover rates of nurses (Guillaumie et al., 2017). Burnout is the sense of (a) ineffectiveness, (b) presenteeism, or the reduction in productivity of an employee, and (c) overwhelming emotional exhaustion and depersonalization (Melnyk, 2020). This leads to (a) anxiety, (b) depression and (c) suicide (Melnyk, 2020). Healthcare professional's stress, burnout, depression and suicide is a current public health epidemic, and threatens not only the well-being of health professional but is a threat to healthcare quality and safety (Melnyk, 2020). Burnout is said to affect approximately 50% of all nurses and is caused by: (a) emotional fatigue, (b) depersonalization, (c) and reduced personal achievement (Shanafelt, 2015). Studies show that 35-54% of nurses and physicians and 45-60% of healthcare learners experience major symptoms

of burnout (National Academy of Medicine, 2021). Increased clinical demands, inadequate patient-staffing ratios, long shift hours, and inefficiency of HER systems are just some factors that contribute to burnout and high attrition rates among nurses (AACN, 2021). Nurses in their first year of work face particularly high attrition rates. A study in 2010 indicated that the turnover rate for first-year nurses in the United States was 28% (Turner & McCarthy, 2017).

Depression and anxiety are also on the rise among nurses and other healthcare providers. Recent studies have found that among these professionals, depression rates range from 25% to 43% (Melnyk, 2020). Another study that examined 1,790 nurses from 19 various healthcare entities across the U.S. found that a third of the sample experienced depression and that depression was the strongest predictor in a nurse making a medical error (Melnyk, 2020). Another alarming statistic is the increase in suicide rates among nurses and physicians, especially in comparison to the general public. The AACN states that the suicide rate for male nurse's vs the general male population is 33/100,000 versus 27/100,000 and the suicide rate for female nurse's vs the female general population is 10/10,000 versus 7/100,000 (AACN, 2021).

Biofeedback Therapy in Stress Reduction

Biofeedback is the process of becoming aware of your body's physiological state (Ratanasiripong et al., 2012). Many biofeedback therapies include using heart rate variability (HRV) for stress reduction. Heart rate variability is the change in the time interval in between successive heart beats as opposed to heart rate which is measured in the beats per minute (Shaffer & Ginsberg, 2017). A high resting HRV is correlated with self-regulatory strength and lower negative emotion during high stress situations, whereas a lower HRV is found during stress from exercise, physical, or emotional stressors (Goessl et al., 2017).

Evidence shows that heart rate variability biofeedback therapy has positive impacts on psychological well-being and stress reduction (Zwan et al., 2015). In measuring stress, anxiety, and depression levels, one study examining heart rate variability (HRV) biofeedback therapy on graduate nursing students showed significant decrease in stress, measured by the Perceived Stress Scale, a significant decrease in anxiety, measured by the STAI-State Anxiety Scale, and a significant decrease in depression, as measured by the Center for Epidemiological Study-Depression Scale (Ratanasiripong et al., 2015).

In a study on building resilience among college students, it was found that the use of HeartMath significantly improved the participants' Brief Resilience Score from pre- to post-intervention, concluding that biofeedback of heart rate variability positively impacts resilience (Sha'ari & Amin, 2021). Further, a study on reducing school burnout and improving cardiac health in college students showed that a self-regulatory biofeedback intervention program not only decreased school burnout via use of the School Burnout Inventory scale but also improved systolic blood pressures and decreased heart rates (May et al., 2018).

Heart rate variability is an important indicator in health and fitness and reflects our ability to adequately adapt to stress (HeartMath, 2021). A low age adjusted HRV can be predictive of future health challenges in healthy people and correlates with all-cause mortality (McCraty et al., 2019). HeartMath uses a bluetooth sensor called The Inner Balance to assess one's HRV. This has been shown to improve personal resilience and increase one's ability to self-regulate (a) emotions, (b) behaviors, and (c) thoughts (McCraty & Shaffer, 2015). When incorporated consistently into one's daily life, HeartMath can significantly reduce stress levels (Lemaire & Wallace et al., 2011).

Incorporating Mental Health Promotion in Nursing Education

The American Association of Colleges of Nursing has implemented a Call to Action for academic nurse leaders. This call emphasizes the importance of promoting practices that enhance students' well-being into nursing schools across the U.S. (AACN, 2021). Such initiatives reflect the idea that nursing education has a duty to ensuring that students are geared with tools for stress management and prevention. Integrating effective mental health promotion into undergraduate nursing programs show that students have improvements in their (a) physical, (b) psychological, (c) spiritual, and (d) social health (Tsai et al., 2020). Studies have shown that subjects exposed to stressors, but that also have a network of emotional support still report feelings of happiness (Pulido-Criollo et al., 2018). Nursing students who develop effective mechanisms for managing stress show reductions in adapting poor coping skills such as (a) consuming alcohol, (b) social isolation, and (c) development of mental health disorders (Reeve et al., 2013).

In a study evaluating the effects of music therapy on salivary cortisol levels of nursing students in a college in Taiwan, it was found that the music treatment reduced cortisol levels by the end of the intervention (Pulido-Criollo et al., 2018). Further, a study incorporating a traditional Chinese exercise called Qigong on nursing students to assess physical activity impact on stress, students reported lower scores of (a) depression, (b) anxiety, and (c) stress by the end of the 10-week period, which correlated with the students salivary cortisol levels (Pulido-Criollo et al., 2018). An 8-week mindfulness-based online program offered to nursing students to reduce stress showed a significant reduction in stress levels at the end of the program, and 24-weeks after the completion (Spadaro & Hunker, 2016).

An integrative review showed that nursing education that incorporates the development of resilience skills among students better prepares those students for stressful encounters during their nursing practice (Cleary et al., 2018). Although the review included quantitative and qualitative research of 14 studies to show there is a positive correlation between nursing programs that foster resilience and emotional intelligence and professional and academic performance. However, due to lack of insufficient research, no statistically significant results were found (Cleary et al., 2018). There needs to be more research in this area to show that incorporating mental health promotion skills and techniques in the nursing education program results in better academic performance of students.

Summary of Evidence

The purpose of the literature search was to evaluate current research on evidence on stress among undergraduate nursing students, its impact on health and nursing career, biofeedback techniques on reducing stress, and the effects on incorporating stress reduction into nursing programs. There was much literature on stress among undergraduate nursing students, and its impact on physical, mental, and emotional health. However, there was not as much literature on biofeedback interventions on reducing stress among undergraduate nursing students.

Overall, it was agreed upon that nursing students undergo immense stress due to clinical and academic stressors (Bartlett et al., 2016). There was also much evidence to show that stress has negative effects on a person's (a) mental, (b) emotional, (c) physical, and (d) spiritual health (Pascoe et al., 2019). Not only did the studies found show that stress negatively impact a nursing student's (a) communication, (b) learning, and (c) academic performance, but can have negative consequences on patient care during clinicals (Aloufi et al., 2021). The evidence showed that biofeedback techniques, such as HeartMath, can have significant positive impacts on a person's

well-being and resilience (Zwan et al., 2015). However, the literature also suggests that in comparison to other mindfulness-based stress reduction techniques, there was not a significant difference in stress reduction. More research needs to be done on incorporating biofeedback techniques into nursing programs as a means for reducing stress among students.

Synthesis of Evidence: Overall Strength and Quality of Evidence

A total of 30 papers were evaluated for the evidence appraisal. The strength of evidence of the papers found was assessed by (a) reviewing the limitations, (b) reviewing the consistency, (c) reviewing the obtainment of objectives, and (d) reporting of bias. The quality of evidence is assessed based on the type of study reviewed. The levels of evidence of the papers appraised ranged from I-VII using the level of effectiveness rating scheme (Ackley et al., 2008). Evidence reviewed included:

- Five Level Is (Aloufi et al., 2021; Cleary et al., 2018; Goessl et al., 2017; Guillaumie et al., 2017; Turner & McCarthy, 2017)
- Four Level IIs (Lemaire et al., 2011; Niknami et al., 2015; Ratanasiripon et al., 2015; Zwan et al., 2015)
- Three Level IIIs (Alghamdi et al., 2019; HeartMath, 2021; May et al., 2018)
- Seven Level IVs (Ekanayka, 2016; Frazier et al., 2019; McCraty et al., 2019; Rathnayke & Shanafelt et al., 2015; Savitsky et al., 2020; Sha'ari & Amin, 2021; Tsai et al., 2020)
- Four Level Vs (Melnyk, 2020; Pascoe et al., 2019; Pulido-Criollo et al., 2018; Seppala et al., 2020;)
- Four Level VIs (American Institute of Stress, Statista Research Department, 2022; Bartlett et al., 2016; Spadaro & Hunker, 2016)

- Three Level VIIs (AACN, 2020; Melnyk, 2020; National Academy of Medicine, 2021;)

Most of the papers reviewed were Level 4 studies, which are well-designed case or cohort studies. The five Level I studies were systematic reviews or meta-analyses, three of which were of high-quality rating and the other two were moderate-quality rating, due to their small sample sizes. The four level II studies were well-designed randomized control studies, all of which were high-quality rating due to their design and sufficient sample size. There were three Level III studies (well-designed controlled trials without randomization). Two of these studies were high-quality due to their larger sample size, but one study was of moderate-quality due to a smaller sample size that was all female. There were seven Level IV studies (well-designed case or cohort studies). This was the most common type of study found in the literature search because most of the papers consisted of evidence from well-designed case studies in which the sample was not controlled or randomized. However, the quality of evidence was of high-quality due to the design of the studies and the larger sample sizes. There were four Level V studies (systematic reviews of descriptive or qualitative studies). Three of the studies were of high-quality including numerous papers in the review, but one study was moderate-quality due to using just a single-author for the search and no time restraint for the review. There were four Level VI studies which consisted of evidence from single descriptive or qualitative study. These studies were all of high-quality due to their larger sample size. There were three Level VII studies, which included evidence from experts or committees. The most common limitation in most of the studies reviewed were that they consisted of mostly female samples due to the demographic of most nursing programs. The studies consisting of mostly female samples or those of small sample sizes cannot be generalized.

Recommendations for Quality Improvement Intervention

Based on the available knowledge and synthesis of evidence, there was support for using a biofeedback therapy like HeartMath as a stress reduction technique among undergraduate nursing students (Clearly et al., 2018; Zwan et al., 2015). There was also strong evidence that supports the need for incorporating stress reduction and mental health promotion into undergraduate nursing programs (Cleary et al., 2018). A quality improvement intervention project was the most applicable. The intervention will use evidence-based research derived from the literature review to guide the intervention to improve health outcomes of nursing students. A major gap in the research found during the literature review was the lack of research on biofeedback interventions on undergraduate nursing students to reduce stress levels. Although the literature review did not determine there was a statistically significant difference between the various mindfulness approaches to reduced stress levels in students, there has been numerous studies on the effectiveness of biofeedback interventions overall on reducing stress levels.

Fit, Feasibility, and Appropriateness of Recommendations for Translation and Improvement

Fit and feasibility of translating a practice question into practice can be assessed through evaluating and examining (a) the resources available, (b) the readiness for change, and (c) assessing the risks and the benefits involved with implementation. Further, strong and high-quality evidence does not always necessarily mean the change fits within the institutions organizational structure. It is imperative that the change also incorporates the organization's missions, goals, objectives and priorities.

Incorporating stress reduction education into undergraduate nursing programs can be fit and feasible under the right action plan. Implementing HeartMath biofeedback technology can be

done on an as needed basis, particularly for nursing students who exhibit high levels of stress. The counseling center at Jacksonville University promotes the use of HeartMath currently with all JU students, and has devices that are able to be lent out. However, the current amount of HeartMath devices that the counseling center has is low compared to student population, and the addition of more devices would further increase the feasibility of the practice change. Another aspect that would improve the fit of the practice change is the willingness of the professors and administrators of the undergraduate nursing program to incorporate stress and anxiety reducing techniques into an already busy education program.

Implementing this practice change would improve outcomes, particularly those of the students. Enhancing resilience and improving coping mechanisms is shown to correlate with lower levels of stress and anxiety (Cleary et al., 2018). Evidence shows that overall, students who report lower levels of perceived stress tend to have better academic performance than students who report high levels of perceived stress. Further, the evidence consistently shows that HeartMath decreases levels of stress and anxiety in participants, showing a definite improvement in well-being outcomes.

The findings from the evidence are very applicable to the JU undergraduate nursing program. Even if the use of HeartMath cannot be implemented into a designated program for stress reduction and resilience, it can be implemented with students who vocalize or show high levels of perceived stress. Surveys can be administered to students periodically to assess their perceived stress levels and suggestion of the use of the HeartMath biofeedback technology can be done to those who result with high levels.

Theoretical Framework

The theoretical framework used to guide this project is the Transactional Theory of Stress and Coping, developed by Lazarus and Folkman, and has remained the cornerstone of psychological stress and coping research (Lazarus & Folkman, 1987) (see Appendix A). This model emphasizes the person-environment interaction and believes that stress and its perception of it is strongly influenced by individual appraisal processes (Obbarius et al., 2021). When confronted with the stressor, Lazarus and Folkman believe that the response is dictated by the individual's evaluation of the relevance of the stressor (primary appraisal) and their own resources to overcome the stressor (secondary appraisal) (Obbarius et al., 2021). These appraisals affect the individual's ability to cope to stressors. HeartMath as a biofeedback technique has been found to improve a resilience and positively impact a person's ability in managing stressors (Sha'ari & Amin, 2021). This project focused on the psychological aspect of resilience learned from the HeartMath technique as a secondary appraisal tool in coping with stressors.

Quality Improvement (QI) Model

The Quality Improvement (QI) Model used for this project was the plan-do-study-act (PDSA) cycle. The scientific method used as a basis for this model: (a) forming the hypothesis is the plan, (b) testing the hypothesis is the do, (c) examining the results of the intervention as the study, and then (d) reporting the results as the act. During the first phase of the model, it is imperative to ask (a) what the goals and objectives are, (b) how will it be known if there is a change or improvement, and (c) what further changes can be made that will result in improvement (John Hopkins, 2022).

A vital part of the testing and implementing practice change is measurement. Four types of QI metrics are: (a) structure, (b) process, (c) outcome, and (d) balance (Johns Hopkins, 2022). This project will look mostly at outcome measurement, or the perceived stress level, as a way of measuring success of the change. Once the plan is set into motion, involving stakeholders when necessary, determining who does what, and gathering necessary resources, the “Do” aspect of the model happens. This will be implementing the HeartMath biofeedback technology and technique among the prelicensure nursing students. When the intervention is completed, the results will be studied via comparing the post-PSS levels to the pre-PSS levels. Finally, by reflecting on the results, action can occur by either (a) adopting the intervention, (b) adapting the intervention, or (c) abandoning the intervention.

The reason for selecting this model was because it captures the essence of the purpose of this DNP project. Discovering a problem and hypothesizing a solution to the problem is most efficiently tested in a plan-do-study-act process. This allows for changes to be made if needed, or if modifications need to be made based on the results of the study.

Specific Aims

The main goal of this project was to evaluate whether the HeartMath technique is effective in reducing perceived stress among undergraduate nursing students. Any improvement in PSS scores of the participants indicates success in the intervention. The point improvement in the individual PSS scores necessary to show statistical significance changes based on sample size and was determined once data was collected.

Specific Aim #1 for this project was to achieve at least an overall 20% reduction in perceived stress level scores from baseline among participants. This was measured by comparing individual post-perceived stress scale scores to the pre-test. The goal appeared to be achievable

since it has been found that the use of HeartMath for at least 6 weeks can show improvements in mental health and well-being, specifically, a 50% reduction in fatigue, 46% reduction in anxiety, and a 60% reduction in depression (HeartMath, 2021).

Process objectives of the project was adherence of the technique. Thus, Specific Aim #2 was for each participant to practice the technique three or more days a week. Further, a long-term implication of this project is for the Keigwin School of Nursing at Jacksonville University to incorporate a well-being course for the undergraduate nursing students and including the use of HeartMath in this course.

Context

Project Site and Population

The project was implemented among prelicensure nursing students. Participants included males and females, aged 18 years and older. All participants were a part of the undergraduate nursing programs, including the traditional program, both 12- and 16- month accelerated programs, and nursing students from the re-entry program. The re-entry nursing programs exist for students who were previously in the traditional undergraduate nursing program and either withdrew or were dismissed from the program.

Analysis of Strengths and Opportunities

Compliance of the students could be a major factor that will influence the strength and success of this DNP project. Frequently using Blackboard for communication among the participants will increase the compliance and success of this project. Further, Blackboard will also be used to leverage the recruitment aspect of the project, which is another major factor in the success of the project. The success of this project is dependent on the voluntary participation and

compliance of the undergraduate nursing students. Keeping the participants engaged with videos and trainings regarding HeartMath is imperative.

A major strength and opportunity for this DNP project was the collaboration and cooperation with Dr. Jennifer Weldon. Dr. Weldon is HeartMath certified trainer and has volunteered her time and knowledge to the development of this project. Her input has a major positive influence on this project and implementing it among the undergraduate nursing students.

Opportunities/Barriers

A few opportunities existed to implement this project successfully. A great financial barrier to the project was the price of the HeartMath devices. The retail price of HeartMath devices are around \$160 and about 40 devices were thought to be needed for this project. However, this barrier was overcome by receiving the Riverside Hospital Grant and an internal scholarship through HeartMath. Other barriers to implementing the project include COVID-19 and the ability to meet in-person for the initial presentation, the compliance of the students to the intervention, determining the population being used. Due to the COVID-19 pandemic, in-person presentations provided an obstacle. It was decided that a virtual course would be best, with the ability to watch the presentations at a later date if needed. Adherence to the intervention was self-reported by each participant. A question on the post-scale survey was asked of the frequency of the participants use of the intervention. Further, as this project used volunteers, the timeline of this project was determined based on the semester, which posed a challenge in coordinating when to implement.

Impact on Workflow and Policies or Procedures

The students' workflow could have been impacted in that they had to set aside some time to implement the HeartMath technique and use the device. The faculty's workflow was

moderately impacted in that it took some time to set up the Blackboard course. No policies or procedures of the students or faculty were impacted.

Support for the Project

Personnel & Key Stakeholders

The key stakeholders in this project were Dr. Teri Chenot, Dr. Weldon, and Jeff Goelitz. Dr. Chenot was a key stakeholder who was the chair of the DNP student. She had been a mentor throughout the DNP program and was key in the implementation of this project. Dr. Weldon is the Assistant Director and Clinical Training Coordinator of the counseling services at Jacksonville University. She is a licensed psychologist and is a certified HeartMath trainer. She has been trained in HeartMath for over 10 years and uses the technique on campus with students seeking her services. Dr. Weldon led the introductory presentation on the HeartMath technique to the students and assisted in the Blackboard course.

Funding for HeartMath Equipment

Jeff Goelitz was a key stakeholder of the project for HeartMath. Mr. Goelitz was the Director of Education of HeartMath and worked with the HeartMath scholarship committee to secure a reduced rate for the needed equipment. The Riverside Hospital Scholarship was awarded to this project for \$2,500 to be used for the HeartMath devices. A scholarship grant through HeartMath was applied for and accepted. The scholarship committee of HeartMath approved all 40 devices to be purchased at a discounted rate of \$2,500 which was supplied with the Riverside Hospital Scholarship. The devices were donated to the Jacksonville University Counseling Center upon completion of this project.

Intervention Description

This quality improvement project implemented an educational intervention. Quantitative data via the Perceived Stress Scale was collected to measure the outcomes. This project was delivered using a Blackboard course. Recruitment of the participants was done via an announcement to all students in the prelicensure nursing programs. All communication regarding recruitment took place via this Blackboard page. Upon accepting part as a volunteer, each student became a member of a separate Blackboard page dedicated to this project. The Blackboard course was presented under the organization tab and each participant had access to this course. Participants individually signed up for a time slot to pick up the Inner Balance devices and take the pre-survey. At the end of the intervention, participants signed up for individual time slots to return the devices and fill out the post-survey.

Announcements and communication about the project occurred via the Blackboard course. The Blackboard course was divided into weekly folders in which resources regarding the HeartMath technique were posted. Dr. Weldon posted an introductory presentation on the HeartMath Inner Balance devices and the HeartMath technique. The weekly resources were posted at the beginning of each week and were available for viewing at any time by the participant.

Videos gathered from the HeartMath experience website were posted on the Blackboard course for the students to watch and further learn the technique. Participants were taught how to use the Inner Balance devices. The intervention was implemented as a virtual course on Blackboard, with HeartMath training videos posted for viewing on their own time. The videos that were posted on the Blackboard course are also those available to the public for viewing via The HeartMath Experience website. These videos further discussed the many benefits of the

biofeedback intervention along with more training and instructional videos on the technique and technology. These videos have been declared for permission to be used in educational settings and free to be re-posted. The purpose of the Blackboard course was to keep the students involved and educated on how to use the device and biofeedback technique. Each participant was expected to perform the biofeedback technique at least once a day for the 6-week project duration.

The participants signed an informed consent that gave full disclosure of the project. It was emphasized to the students that their grades in their classes were not impacted based on their choice to participate or not. Also included in the informed consent was acknowledgement that students may quit at any time during the intervention without repercussion. Students signed the informed consent (Appendix E) and a waiver (Appendix F) that held them responsible for the price of the device if not returned promptly following the intervention. Contact information about the Jacksonville University Counseling Center was given to all students.

Timeline of Project Phases

The initiation of the DNP project was aimed to be during the fall semester of 2022. The HeartMath Blackboard course was six weeks long. After IRB approval of the project, one week was dedicated to setting up and putting together the Blackboard course. Devices were handed out on campus the following week, which was also the start of the Blackboard course. Students picked up their device on campus, accessed the initial introductory videos via Blackboard, and filled out the initial Perceived Stress Scale via Blackboard the first week. The next five weeks were solely virtual, with students expected to practice the technique daily. Announcements via Blackboard were sent out weekly as a reminder for the students to practice the intervention. Training videos from the HeartMath website were posted weekly for the students to access. The week following the

completion of the 6-week intervention, students returned their devices on campus, along with filling out the post-survey.

Upon completion of the course, and after all participants had submitted the final Perceived Stress Scale, statistical analysis was performed. With assistance from the statistician, pre- and post-scales were examined, and results were interpreted. When the statistical analyses was completed, the next step was evaluating the outcomes and assessing if an improvement was made. Finally, the paper was written up for the DNP defense and final publication.

Study of Intervention

This quality improvement study was performed using prelicensure nursing students. The purpose of this study was to investigate the impact of a biofeedback intervention using HeartMath devices on perceived stress levels of undergraduate nursing students. HeartMath is an evidence-based methodology, validated by HeartMath researchers and used to develop and teach techniques to foster well-being and resilience (Clark & Gorton, 2019). HeartMath is used internationally and has been taught in over 2,500 schools and over 200 universities (Clark & Gorton, 2019). The specific technique used in this intervention was heart-focused breathing and the use of positive emotions to elucidate a feeling of calm and reduce stress.

The HeartMath devices used was the Inner Balance Coherence Sensor via iOS or Android. These sensors are used with the Inner Balance App on the phone, which is available for free from the App Store or Google Play. The sensor was placed on the participant's ear and becomes an advanced heart-rate monitor that can measure very subtle changes in heart rhythm, called the heart-rate variability analysis. Using the Inner Balance App and sensor, the participant can see their own heart-rate variability. The HRV analysis is a noninvasive measurement that reflects the heart-brain interaction and is sensitive to changes in the emotional state. The heart

rhythm feedback of the app allows the participant to know when they have a high HRV and thus are in coherence.

Measures

Instrument

The Perceived Stress Scale-10 (PSS-10) (see Appendix B) is a 10-item self-report tool modified from its original 14-item tool used to analyze the degree in which a person perceives situations in their life as stressful. First evaluated by Sheldon Cohen, Tom Kamarck, and Robin Mermelstein in 1983, it is general in nature and used to appraise the extent in which the individual sees situations as unpredictable, uncontrollable, and overloading (Cohen et al., 1983). The frequency of these feelings is rated using the timeline of the past month. The tool is used to determine an individual's perceived stress level. The 10-item version of the tool removes four items with the lowest factor loadings (Baik et al., 2019).

Cohen and Williamson (1988) reported that the PSS-10 has an internal consistency reliability of $\alpha = .78$. Since this report, other studies have also reported that the PSS-10 has a good internal consistency reliability and good convergent validity regarding correlation between physical and mental health (Baik et al., 2019). This tool has also been used on nursing students, with a study by Onieva-Zafra et al. (2020) showing that the mean PSS score for the nursing student participants was 22.78 (+/- 8.54), a moderate level of stress. This study also showed that senior nursing students perceive a higher level of stress than nursing students below them in year (Onieva-Zafra et al., 2020). Further, a study by Spadaro and Hunker (2016) evaluating the effectiveness of an online mindfulness-based stress reduction program offered to undergraduate nursing students showed a statistically significant reduction in perceived stress levels using the PSS ($p = 0.019$).

This project used the Perceived Stress Scale to measure perceived stress level of students pre- and post-intervention HeartMath intervention. No permission was required to use this scale if its implication is intended for research purposes (see Appendix C).

Data Collection

Data was collected through a pre- and post-survey. Each survey included the Perceived Stress Scale, what gender the participant was, what nursing program the participant was in, and what year in the program the participant was in (see Appendix H). The post-survey was the same layout as the pre-survey except also asking how often the participant practiced HeartMath (see Appendix J). The pre- and post-surveys were completed in person, in a one-on-one private session with the researcher. The surveys were anonymous with the participant choosing a unique 4-digit code for them to use on both surveys, and surveys were placed in a large envelope and placed under lock-and-key.

Analysis

Descriptive Statistics

In addition to evaluating the perceived stress levels of the students, descriptive data collected was the specific prelicensure nursing program the participant was in, how far along in the program the participant was, and the gender of the participant. Practice adherence was evaluated by asking participants how often they practiced HeartMath with options to choose as (a) daily, (b) greater than 3 days a week, (c) less than 3 days a week, or (d) rarely (Specific Aim #2).

Inferential Analysis

To evaluate Specific Aim #1 and the overall goal of the project, significance testing was done to evaluate improvement in the pre and post PSS-10 scores. Scores from the PSS-10 post-test were compared to the same participant's PSS-10 pre-test using the student's student ID

number. The data from this QI project was paired, with results from the post-test being compared to the pre-test using a paired *t*-test. The statistician Dr. Peter Wludyka assisted with statistical tests to evaluate if statistically significant differences were found. Dr. Peter Wludyka has a PhD in statistics and is the Biostatistics Consultant for JU DNP students.

Ethical Considerations

Informed consent was obtained from each participant. A major consideration was if a student were to show any signs of having a dangerous level of stress and anxiety via the PSS-10 instrument. Students were given contact information to the JU Counseling Center for any concerns regarding mental health. IRB approval was needed for implementation of this project. After approval of the project through IRB, the project was implemented for 6-weeks. The biofeedback stress reduction intervention used in the project was minimal risk. Following implementation, the statistician was consulted for help in using statistical tests and determining if there were any statistically significant outcomes in this project. The pre- and post-surveys were only in print form and kept under lock-and-key, with only the DNP student and chair having access.

The final paper was presented as a DNP defense for Jacksonville University. The paper will be submitted to the *Journal of Nursing Education* for possible publication. Data from the project will be destroyed 3 years after completion of the project.

Results

Recruitment was performed by posting an announcement on the undergraduate nursing Blackboard page for all undergraduate nursing students to view (see Appendix G). Each participant was met one on one to fill out the pre-survey (see Appendix H) using a unique 4-digit code that only the participant knew and would use on the post-survey as well. Students also signed the

HeartMath device waiver form and the informed consent (see Appendix E). Each week, resources were posted on the HeartMath Blackboard page for the participants to view at their own discretion. It was continually emphasized that the students use the intervention daily through weekly announcements (see Appendix I). At the end of the 6-week intervention, participants were met again, one on one, to fill out the post-survey (see Appendix J). The post-survey was the same as the pre-survey except adherence of their practice was measured as well. Pre- and post-surveys, informed consent, and HeartMath device waiver forms were kept under lock and key in Dr. Chenot's office on the Jacksonville University Campus. The Perceived Stress Scale scores from the pre- and post-survey scores and adherence were put into an excel sheet, using the identification codes that the participants gave. Since no identifying data was used, the excel sheet was emailed to statistician Dr. Peter Wludyka for analysis.

Results of the Perceived Stress Scale for pre- and post-intervention and compliance of the technique were as follows:

Table 1

Results from Pre- to Post-Survey

PARTICIPANT#	PRE-PSS	P-PSS	GENDER	ADHERENCE
7290	17	18	F	<3days
4710	27	13	M	>3days
2954	17	13	F	>3days
9174	10	13	F	<3days
7931	15	12	F	>3days

Comparison of the pre-PSS scores and post-PSS scores were analyzed by statistician Dr.

Peter Wludkya. The hypothesis for the paired t-test were:

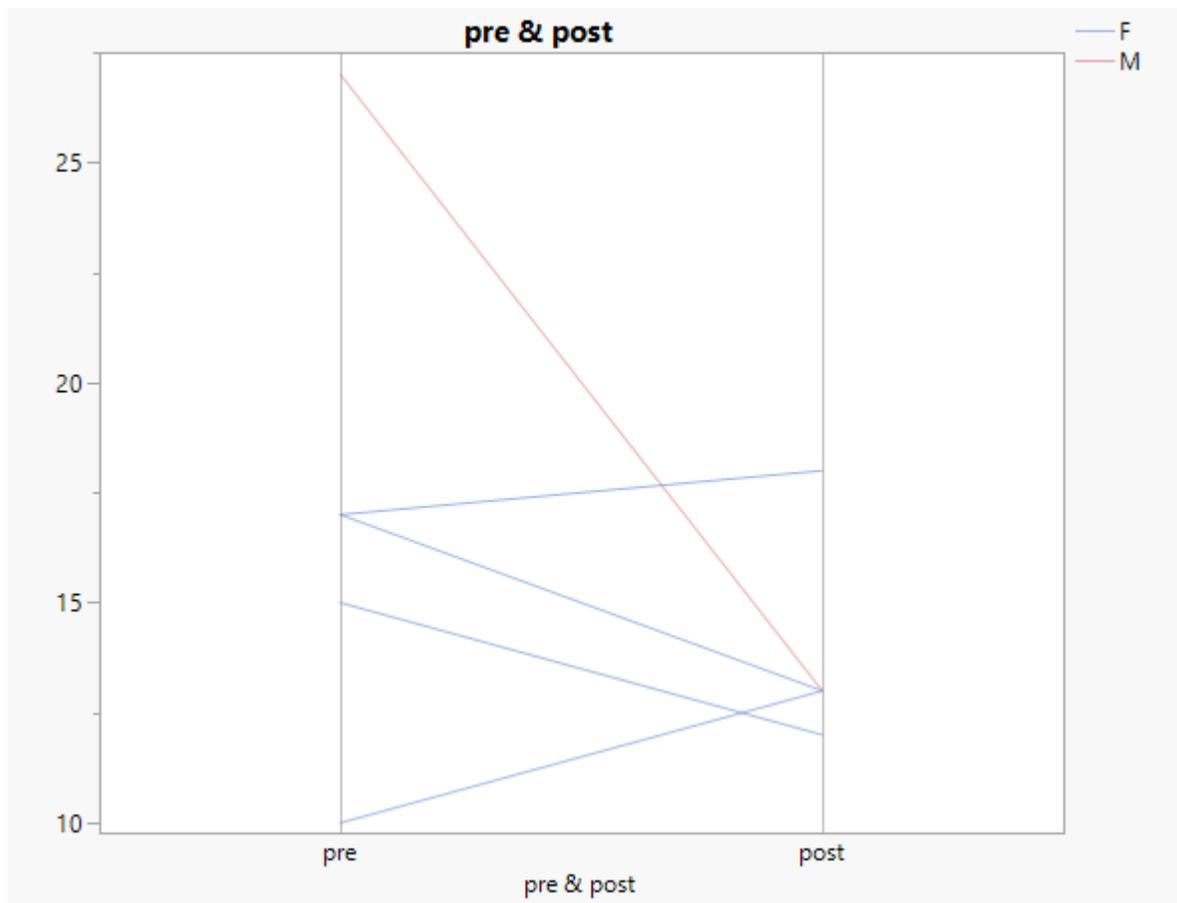
H0: population mean pre = population mean post

Ha: population mean pre not = population mean post

At a p -value of $p = 0.3123$, the H0 was failed to reject, indicating that there was not a significant change in results from our pre-survey to our post-survey. In other words, overall scores on the PSS were not significantly different before and after the intervention. However, for three of the participants, PSS decreased after the HeartMath intervention. Two of the participants showed an increase in PSS after the HeartMath intervention. Below is a profile plot, with individual lines connecting pre- and post-PSS scores for the participants.

Figure 1

Comparison of Individual Pre- and Post-PSS



Although there was not a significant change, when evaluating overall results of the pre- and post-PSS scores, the statistician concluded that there was an 11.9% reduction from the pre- to the post-scores for the group, indicating a trend toward improvement.

Mean	11.899782
Std Dev	31.099943
Std Err Mean	13.908317
Upper 95% Mean	50.515461
Lower 95% Mean	-26.7159
N	5
N Missing	0

The average reduction was 11.9% (95% CI -26.7 to 50.5). Three of five participants had 20% or greater improvement of scores. Two participants demonstrated an increase in perceived stress levels.

Specific Aim #1 of the project was for there to be an average reduction of 20% in the perceived stress scale scores among the group of participants. Three out of the five participants had a greater than 20% reduction in perceived stress levels, however the average reduction of 11.9%. Although there was overall improvement for the group, since it was not 20% or greater, specific aim #1 was not met.

Specific Aim #2 of the project was for there to be an adherence rate of greater than three days a week for all participants. Adherence was evaluated by participants reporting either (a) daily use, (b) greater than three days a week, (c) less than three days a week, or (d) rarely using. Three of the participants reported practice three days a week or greater during the intervention.

Two of the participants reported less than three days a week of practice. This is a 60% adherence rate of three days a week or greater, and thus, specific aim #2 was not met.

Contextual Elements/Influence On Intervention

Compliance of the technique and timing of the post-survey may have impacted the perceived stress scale scores from the post-survey. Although it was emphasized at the beginning of the study, only 3 out of the 5 participants used the intervention greater than 3 days a week, and none of the participants claimed to use the intervention daily. If the students had practiced the intervention daily, this may have further reduced their perceived stress levels. Further, the post-survey was given at the end of the semester, around final exams time. The timing of the post-survey may have caused students to be naturally more stressed in comparison to when they took the pre-survey, and thus might not have been an accurate representation of the effects of the intervention. Having a control group for comparison could have accounted for this unintended external factor.

Summary

Key Findings

This project did not show that there was a statistically significant difference in perceived stress levels in individual participants after using a HeartMath intervention for 6-weeks in comparison to before. However, there was a nearly 12% improvement in perceived stress levels on average after completing the intervention. Although the overall reduction percentage did not meet the specific aim goal of 20%, any improvement and incorporation of a mindfulness program into the undergraduate nursing curriculum is addressing the AACN Call to Action (AACN, 2021). Recruitment and adherence were both issues with this project. To have a greater impact on the local problem, the HeartMath technology would be more beneficial to students who show and

interest in practicing the technique and using the device daily. This would most likely include students who are seeking out interventions and coping mechanisms to use for their stress and anxiety.

Project Strengths

The strength of this project was its incorporation of a Blackboard course to implement a program focused on stress reduction for undergraduate nursing students. Finances and time may make an in-person class not feasible but creating a course with resources for stress and anxiety reduction that is available to all nursing students to access at their own discretion and need could be more financially feasible. Further, having resources and technology such as HeartMath available for all students could prevent many students from reaching such high levels of stress and anxiety to the point of seeking out psychiatric help.

Interpretation

It is difficult to determine if there is an association between the HeartMath intervention and the outcomes. Perceived Stress Scale scores decreased for three of the participants but increased for two. However, the students that scored higher on the post-survey also claimed to have utilized the intervention less than three days a week, whereas students who scored lower on the stress scale following the intervention, claimed to have practiced greater than three days a week. Practice compliance, and timing of the post-survey may have contributed to the scores, and thus, finding a direct correlation between HeartMath use and perceived stress scores cannot be determined.

The existing literature shows that biofeedback techniques, such as HeartMath, can have significant improvement on stress and anxiety levels (Ratanasiripong et al., 2012; Zwan et al., 2015). In Ratanasiripong et al. (2012), a research study was conducted using 60 graduate students in a public health nursing program in Thailand. The biofeedback intervention implemented in this

study was assessing heart rate variability (HRV) through a portable device for 4-weeks. The Perceived Stress Scale was used to assess the perceived stress levels before and after the biofeedback intervention, along with the State Anxiety Scale and the Center for Epidemiological Study-Depression Scale. A control group was utilized to compare results following the biofeedback intervention. The results of this study showed that participants in the intervention group had statistically significant decrease in the Perceived Stress Scale scores in comparison to the control group.

Zwan et al. (2015) conducted an RCT comparing the efficacy of various stress reduction techniques, one of which was heart rate variability biofeedback. The participants in the HRT group utilized a HRT biofeedback device while implementing the use of slow breathing. Inclusion criteria of the study included scoring above a 17 on the Dutch version of the Perceived Stress Scale. Results of the interventions were assessed using the Dutch version of the Depression Anxiety Stress Scales, the Pittsburgh Sleep Quality Index, and the Scales of the Psychological Well-being. To maximize compliance, participants made a plan each week, for the following week, of the daily time and place for practicing the intervention. This study utilized technology such as text messages to send daily reminders to each participant as well, and assistants called participants weekly to assess progress.

Although it was not found to determine a statistically significant change in perceived stress scores of undergraduate nursing students before and after implementing the HeartMath technique, as was the anticipated outcome, there was an established improvement overall in scores after the HeartMath intervention. This result is encouraging, especially considering that it was final exam week when the post-survey was administered.

This project impacted the students who volunteered to be participants. However,

implementation of a program incorporated into the undergraduate nursing programs that taught and emphasized stress and anxiety reduction, using HeartMath as an intervention, would impact the nursing program as a whole. If a class were to be formed for all nursing students on the Blackboard organization page, such as the Blackboard course for this project, resources and stress reduction techniques could be posted there for the students to have access to and gain information from on their own time and would cost very little to organize.

In the future, HeartMath could be implemented among whole cohorts of the nursing program for further research. It could also be utilized on an individual basis, for nursing students that show high levels of stress. As HeartMath is already a technique that is used at the Jacksonville University Counseling Center, it could be promoted and encouraged for use during all nursing program orientations.

Limitations

The major limitation to this project was the recruitment and compliance. Because participation in this project was solely voluntary and not associated with any particular class, recruitment was difficult, and the number of participants was low. Also, when the participants filled out the post survey and selected how often they practiced the technique, none of the students selected daily, with a little over half stating that they practiced greater than three days a week. Announcements were sent weekly to remind the students to practice daily in order to minimize poor compliance.

Further, the Jacksonville area was impacted by a hurricane at the same time as the original start week, stalling the start of the project a week and having the end of the project coincide with finals week. This led to the post survey to be filled out when the participants were taking their final exams and could have affected their perceived stress scale scores at that time.

Conclusions

The significance of the project addresses the need for nursing programs to focus on the mental health of their undergraduate nursing students. Implementing a Blackboard course that focuses on stress reduction is an efficient and feasible way to have resources available for students. This project could be further modified to include any stress reduction technique and implementing a Blackboard course to help guide students and give resources. This project could be very sustainable if all nursing students were automatically added to the Blackboard course upon starting their nursing program and were able to obtain the HeartMath devices at any time when needed.

As stress levels among nursing students increases, the significance of implementing stress reduction techniques in nursing programs increases. Research of HeartMath shows that it can drastically improve many aspects of mental health in individuals, particularly reducing stress and anxiety. Although this project could not prove that there was a statistical significance in changes in perceived stress levels before and after the use of HeartMath, it does show that overall, stress levels did reduce when using HeartMath.

A lesson learned when implementing this project was that it would be better to recruit whole nursing cohorts, rather than on an individual basis. Recruitment may have been better if a nursing instructor was involved in recruitment, or if there was an incentive to volunteering. Further, external factors such as timing of the post-survey with final exams could have been accounted for if there was a control group in addition to the intervention group.

Because daily use of HeartMath might not appeal to a lot of people, assessing changes in stress levels over a period of time, when daily use is encouraged to see change, might not be the best way to evaluate correlation. Many external factors also influence the results, such as the timing of when each survey is administered. Comparing stress levels immediately before, and then

immediately following, the use of HeartMath, may be an indicator of direct correlation in stress levels.

Dissemination plan for this project include presenting it as a DNP defense and submitting for publication to the *Journal of Nursing Education*.

Project Funding

The Riverside Hospital grant funded a substantial amount of this project by donating \$2,500 for the cost of the HeartMath devices. Further, HeartMath gave the project an internal scholarship, which reduced the cost of all devices to \$2,500. The devices will be donated to the Jacksonville University Counseling Center. No other funding was given to this project.

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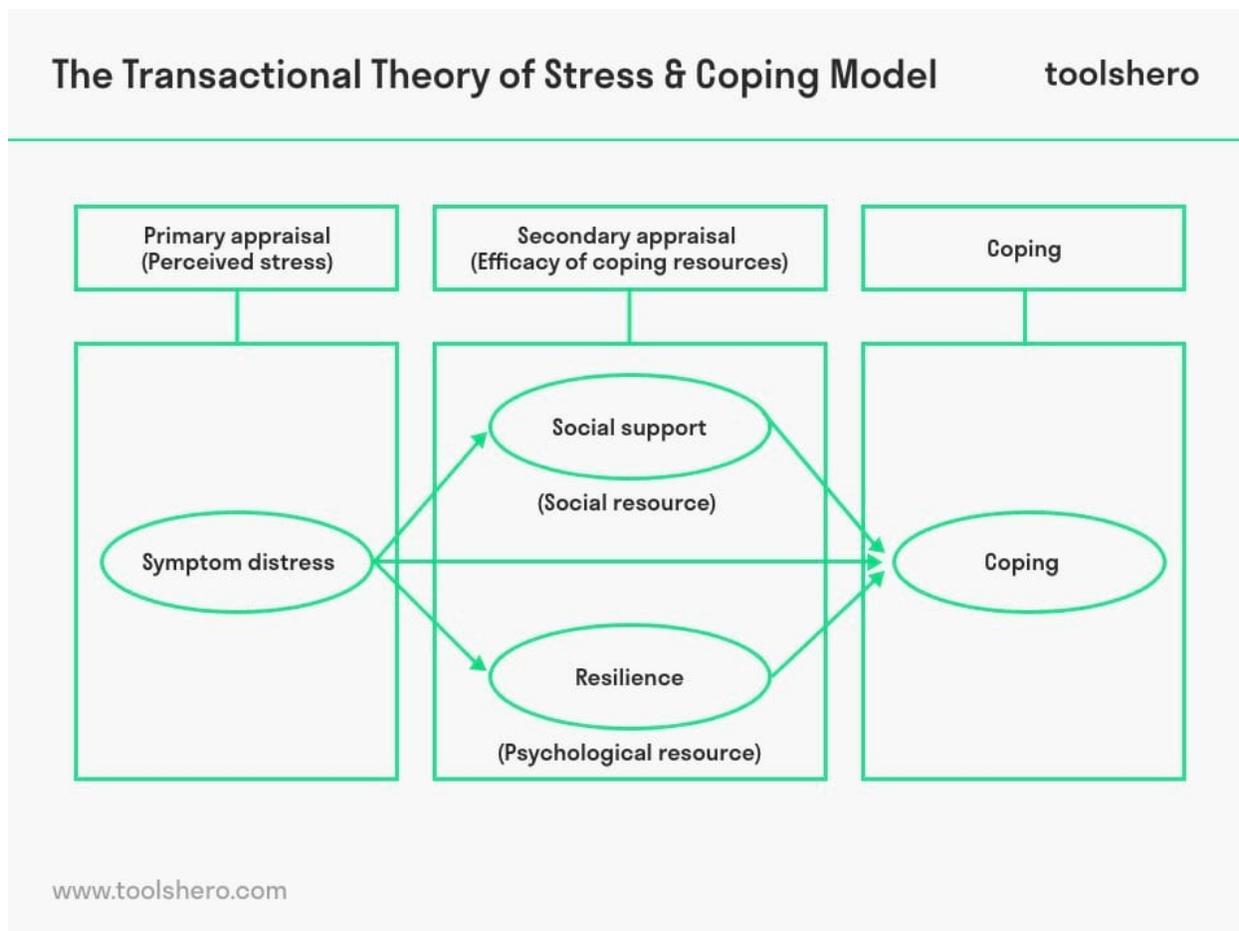
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Appendix A

The Transactional Theory of Stress & Coping Model



Appendix B

Perceived Stress Scale-10

The Perceived Stress Scale-10 that will be given as the pre- and post-test to evaluate the effectiveness of HeartMath in reduced perceived stress levels.

Which undergraduate nursing program is the participant is enrolled in?

Traditional

12-month accelerated

16-month accelerated

Re-entry program

Perceived Stress Scale

A more precise measure of personal stress can be determined by using a variety of instruments that have been designed to help measure individual stress levels. The first of these is called the **Perceived Stress Scale**.

The Perceived Stress Scale (PSS) is a classic stress assessment instrument. The tool, while originally developed in 1983, remains a popular choice for helping us understand how different situations affect our feelings and our perceived stress. The questions in this scale ask about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer fairly quickly. That is, don't try to count up the number of times you felt a particular way; rather indicate the alternative that seems like a reasonable estimate.

For each question choose from the following alternatives:

0 - never 1 - almost never 2 - sometimes 3 - fairly often 4 - very often

_____ 1. In the last month, how often have you been upset because of something that happened unexpectedly?

_____ 2. In the last month, how often have you felt that you were unable to control the important things in your life?

- _____ 3. In the last month, how often have you felt nervous and stressed?
- _____ 4. In the last month, how often have you felt confident about your ability to handle your personal problems?
- _____ 5. In the last month, how often have you felt that things were going your way?
- _____ 6. In the last month, how often have you found that you could not cope with all the things that you had to do?
- _____ 7. In the last month, how often have you been able to control irritations in your life?
- _____ 8. In the last month, how often have you felt that you were on top of things?
- _____ 9. In the last month, how often have you been angered because of things that happened that were outside of your control?
- _____ 10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

Figuring Your PSS Score

You can determine your PSS score by following these directions:

- First, reverse your scores for questions 4, 5, 7, and 8. On these 4 questions, change the scores like this:

$$0 = 4, 1 = 3, 2 = 2, 3 = 1, 4 = 0.$$
- Now add up your scores for each item to get a total. **My total score is _____.**
- Individual scores on the PSS can range from 0 to 40 with higher scores indicating higher perceived stress.
 - ▶ Scores ranging from 0-13 would be considered low stress.
 - ▶ Scores ranging from 14-26 would be considered moderate stress.
 - ▶ Scores ranging from 27-40 would be considered high perceived stress.

The Perceived Stress Scale is interesting and important because your perception of what is happening in your life is most important. Consider the idea that two individuals could have the exact same events and experiences in their lives for the past month. Depending on their perception, total score could put one of those individuals in the low stress category and the total score could put the second person in the high stress category.

***Disclaimer:** The scores on the following self-assessment do not reflect any particular diagnosis or course of treatment. They are meant as a tool to help assess your level of stress. If you have any further*

concerns about your current well being, you may contact EAP and talk confidentially to one of our specialists.

Appendix C

Permission for Use of the PSS in Educational Use

Perceived Stress Scale (PSS)

The Perceived Stress Scale (PSS) is a measure of the degree which situations in an individual's life is evaluated as stressful. Items were designed to assess how overloaded, unpredictable and uncontrollable respondents find their lives. These three issues are central components of the experience of stress. Additionally, the scale includes a number of questions about the current levels of experienced stress. The 14 item scale (PSS14) was developed in 1983 and there has been no major revisions since. A four-item and 10-item (PSS10) versions of the scale has also been validated. The PSS10 allows the assessment of perceived stress without any loss of psychometric quality. The PSS was developed in the USA for individuals with a minimum of a high school education. Items include:

In the last month, how often have you been upset because of something that happened unexpectedly?

In the last month, how often have you felt that you were unable to control the important things in your life?

Psychometric Properties

The PSS14 was factor analysed using a principal components method with varimax rotation. Ten items loaded positively on the first factor at .48 or above. The remaining four items had a low loading <.39. The PSS10 consisted of 10 items eliminated those four items. Cronbach's alpha for the PSS14 was acceptable ($\alpha = .75$). Cronbach's alpha for the PSS10 had a slightly higher reliability score ($\alpha = .78$). Test-retest reliability was not reported. The mean and standard deviation scores for PSS14 and PSS10 were 19.62 ($SD = 7.49$) and 13.02 ($SD = 6.35$) respectively. PSS scores were moderately related to responses on other measures of appraised stress supporting convergent validity. Cross-cultural validations have been conducted (eg. Australia, Japan and Greece). All showed satisfactory psychometric results.

Use

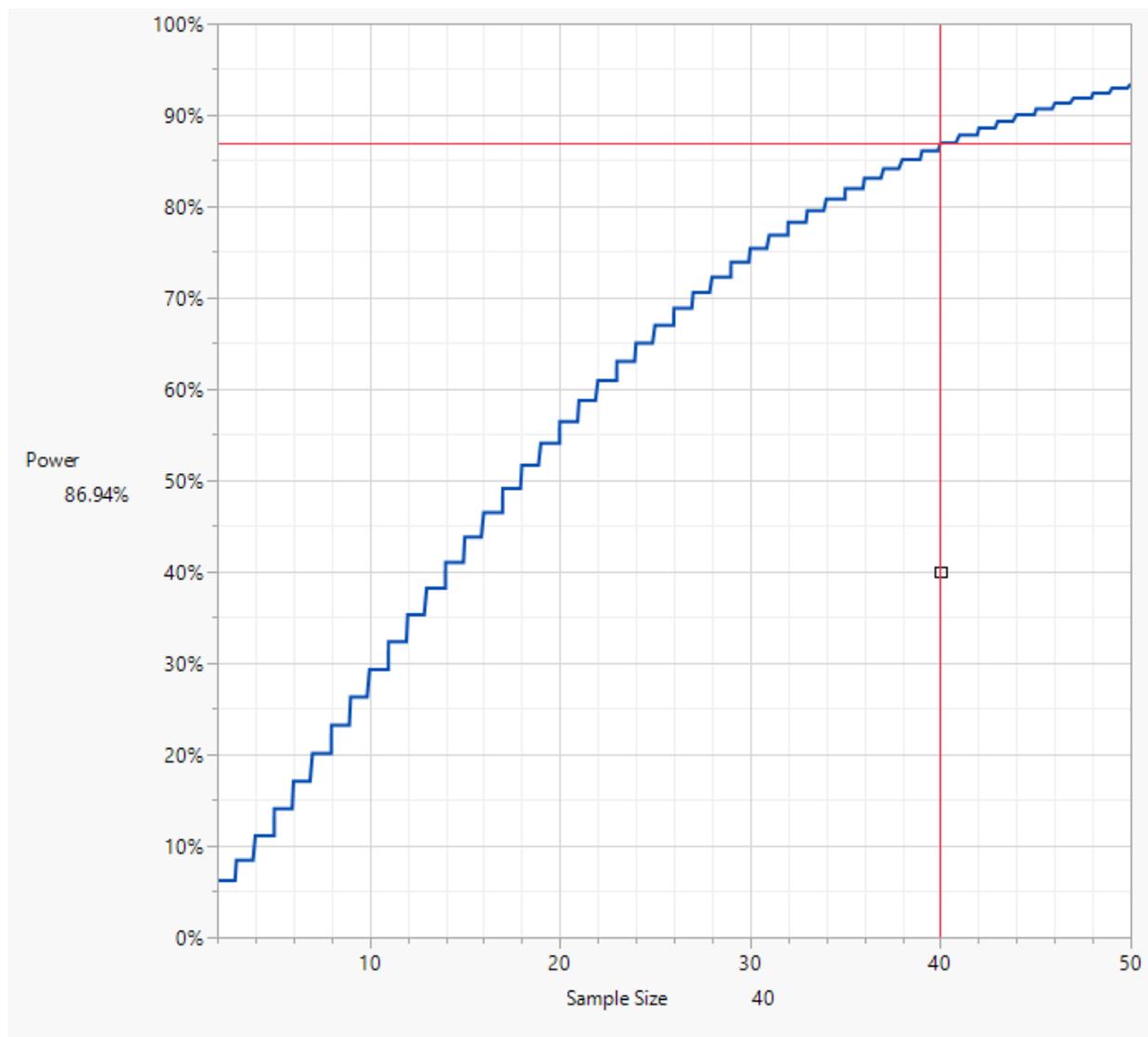
The items of the scale are available in the appendix of the article by Cohen et al. (1983). Alternatively, the PSS can be sourced through a simple search online. **No permission is required to use this scale. It was intended to be an economical tool to be used for research purposes. The PSS is primarily used in research settings.**

References

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Appendix D

Power Analysis Showing Power of Rejecting Null Hypothesis Given Sample Size



Appendix E

Informed Consent Form

Project Summary

Title of the Project: The Use of HeartMath Technology as a Quality Improvement Intervention to Reduce Perceived Stress Levels in Pre-licensure Nursing Students to Improve Outcomes

Project Lead: Melissa Nelsen, DNP candidate, Jacksonville University

Faculty Advisor: Teri Chenot, Ed.D., MS, M.Ed. MSN, RN, CCE, FNAP, FAAN, 904-256-7284

Counseling Center: Dr. Weldon, Assistant Director and Clinical Training Coordinator, 904-256-7555

You are invited to participate in a quality improvement project. In order to participate, you must be 18 years or older and an undergraduate nursing student at Jacksonville University. Taking part in this project is voluntary.

The purpose of the project is: HeartMath is a biofeedback technology that incorporates stress reduction techniques with improving heart rate variability. The aim of the project is to improve outcomes of undergraduate nursing students by reducing perceived stress through the HeartMath technology

If you agree to take part in this project, you will be asked to use the HeartMath EmWave device daily through the use of the Inner Balance mobile application. Upon agreement of being in the project, you will become a part of the HeartMath Blackboard course. Through this course, all communication will take place. You will have to come to campus to pick up the device, sign an informed consent and device waiver form, and fill out the pre-survey. You will then have full access to the HeartMath Blackboard site. The initial training video on using the device and the HeartMath technique will be posted for you to view. You must view this training video in order to learn how to appropriately operate the device. From then on, it is on your schedule when you chose to practice, but it must be daily. The intervention will be 6 weeks. At the end of the intervention, you must come back to campus to return the device and fill out the post-survey. This must be done within a week of finishing the intervention. We expect your involvement on this project will take approximately 7-8 weeks, with 2 on-campus meetings. I will be collecting the following data/information from you age, gender, year of school, nursing program you are in, and the pre- and post-surveys] Your data will not be linked to any classes or school-associated programs. Your data from the Inner Balance mobile application will not be accessed or used for this project.

There are some risks you might experience from being in this project.

There is some emotional risk due to the nature of the questions asked on the survey. Filling out the survey is voluntary, and you can skip any questions that may make you feel uncomfortable. In the event that you need emotional support, please contact Dr. Weldon and the counseling center using

the information provided above. You may also use the [Telehealth for Jacksonville University Students \(thevirtualcaregroup.com\)](http://thevirtualcaregroup.com) twenty-four hours/seven days per week. The telehealth service provides students free unlimited access to therapists and on-demand crisis counseling. You will be asked to create an account to use the service.

The project may also pose a privacy risk. The HeartMath technique is accessed through an application on your phone. Although none of the information on the phone will be used as data for the project, it cannot be ensured that the data from the application is completely protected and not vulnerable to hacking or content sharing.

To participate, you will need to download the HeartMath Inner Balance mobile application. The application is available for Android and Apple users. This application will gather information such as (e.g., heart rate and heart rate variability). However, these data will not be used as part of the project. The project lead will only collect survey data about perceived stress levels before and after using this device, and it is not linked to data collected via the application. You may or may not benefit directly from being in this project. Others might benefit because of learning a technique that has been shown to improve mental and emotional well-being using the HeartMath training and technology.

If you decide to take part in the project, it should be because you really want to volunteer. You will not lose any services, benefits, or rights you would normally have if you chose not to volunteer. There will not be any academic changes to your status as a student based on your decision to participate in the project.

If you are interested in learning more about the project, please continue to read below. If you are not interested stop here.

Thank You.

PARTICIPANT'S NAME (Print): _____

TITLE OF THE RESEARCH PROJECT: The Use of HeartMath Technology as a Quality Improvement Intervention to Reduce Perceived Stress Levels in Pre-licensure Nursing Students to Improve Outcomes

PROJECT LEADS:

Melissa Nelsen, mnelsen1@jacksonville.edu, 904-923-0723

Teri Chenot, tchenot@ju.edu, 904-256-7284

INVESTIGATOR'S STATEMENT: We are asking you to be in a quality improvement project. The purpose of this consent letter is to give you the information you will need to help you decide whether to be in the project or not. Please read this form carefully. You may ask questions about the purpose of the research, the possible risks and benefits, and anything else about the research or this form that is not clear. When we have answered all your questions, you can decide if you want to be in the project or not. This process is called "informed consent." We will give you a copy of this form for your records.

THE PURPOSE OF THE PROJECT: To improve nursing student outcomes by reducing perceived stress levels through HeartMath biofeedback technology.

PROCEDURES: (What is expected from you):

You will be asked to use the HeartMath EmWave device daily through the use of the Inner Balance mobile application. Upon agreement of being in the project, you will become a part of the HeartMath Blackboard course. Through this course, all communication will take place. You will have to come to campus to pick up the device, sign an informed consent and device waiver form, and fill out the pre-survey. Your pre- and post-survey will include the same unique 4-digit code created by you, for only you to know. Thus, all information on the surveys is non-identified. The survey will contain questions asking to determine individual stress levels. You will then have full access to the Blackboard site. The initial training video on using the device and the HeartMath technique will be posted for you to view. You must view this training video in order to learn how to appropriately operate the device. From then on, it is on your schedule when you chose to practice, but it must be daily. The intervention will be 6 weeks. At the end of the intervention, you must come back to campus to return the device and fill out the post-survey. This must be done within a week of finishing the intervention. We expect your involvement on this project will take approximately 7-8 weeks, with 2 on-campus meet ups. I will be collecting the following data/information from you [age, gender, year of school, nursing program you are in, and the pre- and post-surveys]

Approximately, 40 undergraduate nursing students will take part in the project.

If you decide to be in the project, the investigators will collect the following information: age, gender, year of school you are in, and which undergraduate nursing program you are in. This will be collected on the pre- and post-surveys.

We will not be using these de-identified data in future research or projects.

If you have any questions now or at any time during the project, you may contact anyone listed under Investigators.

BENEFITS OF THE PROJECT: You may benefit from learning a technique that has been shown to improve mental and emotional well-being using the HeartMath training and technology.

The scores on the survey may reveal a participant to be in a severe level of stress. Since the surveys will be non-identified, we will not know which survey belongs to which participant. However, if the individual feels as if they are scoring high on the survey and needs counseling services, there will be accessed to contact information for the JU counseling center on the Blackboard site.

No promise or guarantee of benefits has been made to encourage your participation.

RISKS OF THE PROJECT: The risks of taking part in this project are:

There is some emotional risk due to the nature of the questions asked on the survey. Contact information for Dr. Weldon and the counseling center is provided at the top of this form for those students who need it. The participant can skip any questions on the survey that may make them feel uncomfortable.

The project may also pose a privacy risk. The HeartMath technique is accessed through an application on your phone. Although none of the information on the phone will be used as data for the project, it cannot be ensured that the data from the application is completely protected and not vulnerable to hacking or content sharing.

To participate, you will need to download the HeartMath Inner Balance mobile application. The application is available for Android and Apple users. This application will gather information such as (e.g., heart rate and heart rate variability). However, these data will not be used as part of the project. The project lead will only collect survey data about perceived stress levels before and after using this device, and it is not linked to data collected via the application. Below is some basic information:

The mobile app is provided by HeartMath and there are terms of use that the vendor requires of all users.

- *You should review the vendor's terms of use and privacy agreement. (<https://www.heartmath.com/about/privacy-policy/>).*
- *The vendor may retain some of the data collected through the mobile app even after the project ends. If you do not want this data collection to continue by the vendor after the project ends, you should deinstall the app or make a written request to support@heartmath.com with "Remove" in the subject line. The project lead can help explain how to do this at the time you return the heartmath device.*
- *This application may collect information from your mobile phone that would identify your geographic location when data is collected. To help protect your privacy, the project lead can help to deactivate the location services if you wish.*
- *This mobile app will use the data function on your phone, and, depending on much data you use for other things, you may have data charges.*

Specifically, HeartMath may collect a wide range of information from you during your use of their websites or apps. For example, they may collect:

- Anonymous information to better understand your use of our websites and serve you better.
- Contact information, when you subscribe to email lists or certain specific website services.
- Financial information, when you make purchases from our websites.
- If you use our HeartCloud service, we store physiological practice information to analyze sessions for results like awards, to synchronize between your devices and to back up your data.

Heartmath discloses taking great care in storing and protecting the information they collect. You have the right to access your personal data and to delete it. You must be thirteen (13) years of age or older to use our websites and services, otherwise you will need parental consent. Should you have trouble or have any questions about this, please contact HeartMath Support with detailed information.

To minimize the risks associated from being part of the project, safeguards included will be contact information for the JU counseling center for those students who are triggered by the survey questions or feel as if they are in a high level of stress and/or anxiety. Further, none of the data collected via the HeartMath inner balance mobile application will be accessed or used for the project. All surveys will contain de-identified data and students will retrieve devices on a one-on-one basis.

IN THE CASE OF INJURY OR ADVERSE EVENT Please contact the PI of this project immediately, but also in the case of emergency, please seek medical attention. Jacksonville University has not set aside funds for any medical costs, damages, or other financial losses incurred from this project. The only exception is if it is proved that your injury or illness is directly caused by the negligence of a Jacksonville University employee. “Negligence” is the failure to follow a standard duty of care.

If you become ill or injured from being in this project, your insurer may be billed for your treatment costs. If you do not have insurance, or if your insurer does not pay, then you would have to pay these costs. You are not precluded from seeking to collect compensation for injury related to malpractice, fault, or blame on the part of those involved in the project. If you believe you have become ill or injured from this project, you should contact Melissa Nelsen at 904-923-0723. You should also let any healthcare provider who treats you know that you are in a project.

In the event that you need emotional support, please contact Dr. Weldon and the counseling center using the information provided above. You may also use the [Telehealth for Jacksonville University Students \(thevirtualcaregroup.com\)](http://thevirtualcaregroup.com) twenty-four hours/seven days per week. The telehealth service provides students free unlimited access to therapists and on-demand crisis counseling. You will be asked to create an account to use the service. You may also contact Dr. Teri Chenot, Faculty Project Lead at 904-504-3377

COSTS / COMPENSATION: You will not have to pay for taking part in this project. You will not be compensated for being a part of the project.

ALTERNATIVE TO BE IN THE PROJECT: The alternative to not take part in this project is not to participate.

CONFIDENTIALITY: Records or data obtained as a result of your participation in this project may be reviewed by the investigators and/or the Jacksonville University’s Institutional Review Board (JU IRB). However, they are legally obligated to protect any identifiable information from public disclosure, except where disclosure is otherwise required by law or a court of competent jurisdiction. These records will be kept private in so far as permitted by law. Also, other Jacksonville University officials have the legal right to review project records, and they will protect the secrecy (confidentiality) of these records as much as the law allows. Otherwise, your project records will not be released without your permission unless required by law or a court order. However, if we learn that you intend to harm yourself or others, we must report that to the authorities.

We plan to publish the results of this project. To protect your privacy, we will not include any information that may identify you. To protect you we plan to use only non-identified data.

We will not keep your project data to use for future project or other purpose. Your name and other information that can directly identify you will be kept secure and stored separately from the project data collected as part of the project. [OR] Your name and other information that can directly identify you will be deleted from the project data collected as part of the project.

We will not share your project data with other investigators.

CONFLICT OF INTEREST: In general, presenting project results helps the career of a scientist. The project team may benefit if the results of this project are presented at scientific meetings or published in scientific journals.

RIGHT TO PARTICIPATE OR WITHDRAW: You are free to stop taking part in this project at any time without penalty and without losing any benefits to which you are entitled. You will be provided, as applicable, with any significant new findings developed during the course of this project that may relate or influence your willingness to continue participation.

If you decide to stop taking part in this project for any reason, you should contact Melissa Nelsen at 904-923-0723. If you choose to tell the researchers why you are leaving the project, your reasons may be kept as part of the project record. If you decide to withdraw from the project, it may be impossible to exclude the data that has already been collected. In this case, researchers may retain and use data collected prior to your withdrawal, including Protected Personally Identifiable Information (PII), as long as the uses are consistent with the project purpose and procedures as described in the IRB application and consent documents. If you have any questions regarding your rights as a research participant, you may call the JU Office of Research & Sponsored Programs at (904) 256-7151.

You may be withdrawn from the project without your consent for the following reasons: you are not an undergraduate nursing student, you are not 18 years of age, you do not have access to the Heartmath application, and cannot commit time to pick up or drop off the device when prompted

CONSENT TO PARTICIPATE: I have been informed about this project's purpose, procedures, possible benefits, and risks; and the alternatives to being in the project. I have been given the opportunity to ask questions before I sign, and I have been told that I can ask other questions at any time. I understand that my consent does not take away any of my legal rights. I also understand that nothing in this consent form is intended to replace any applicable Federal, state, or local laws.

By signing this form, I voluntarily agree to take part in this project. I am not waiving any of my legal rights. I will receive a copy of this form.

Participant's Name Printed

Participant's Signature

Date

Person Obtaining Consent and Authorization:

Name Printed

Signature

Date

Appendix F

HeartMath Device Waiver Form

Date:

Attention:

Student Phone Number:

We are very pleased to loan you out the Inner Balance technology for 30 days.
When you are done using the technology, please return it to the Student Counseling Center.

Please sign here to indicate your approval of this loaner agreement. Failure to return the unit after 30 days will result in a financial charge to your university account for an Inner Balance Replacement (\$159)

Student Signature

Date

Appendix G

Recruitment Announcement

Participants Needed for a Research Study The Use of HeartMath Technology as a Quality Improvement Intervention to Reduce Perceived Stress Levels in Pre-licensure Nursing Students to Improve Outcomes

The purpose of the quality improvement project is to reduce perceived stress levels among undergraduate nursing students to improve outcomes with the use of HeartMath technology

To participate in this project you must be an undergraduate nursing student at JU, be 18 years or older, and have either an iPhone or android device.

Time commitment, benefits of participation, and compensation: if you are interested in participating in this project, please reach out to us using the contact information below. The first 40 students to respond will be selected to participate and added to the HeartMath blackboard course.

The time commitment is 7-8 weeks long. You must be able to come to campus during one of the designated days to pick up the HeartMath device. At this time, you will sign the informed consent, the device waiver form, and take the pre-survey. More information on the use of the technology will be discussed at time of device pick up and via the initial training video on Blackboard The initial training presentation about the HeartMath technique and how to use the device will be posted on the Blackboard course after you have received the Heartmath device. You will be expected to participate daily for 6 weeks using the HeartMath device, but on your own schedule.

Lastly, you will need to come back to campus during the last week to return the device and fill out the post-survey.

Benefits to participation include learning a new technique that can be used daily, or as needed, to reduce stress and anxiety. No compensation will be given for participating.

Project location: the pick up of devices will take place at the JU Counseling Center

Contact Information:

If you are interested in participating, or would like more information, please contact Melissa Nelsen, Project Lead, at mnelsen1@jacksonville.edu. In your email please include your name, JU email, JU ID, in order to add your name to the Blackboard course. If you have more questions before committing to the project, please feel free to email me.

The faculty of the project is Dr. Teri Chenot who may be reached via email at tchenot@ju.edu or phone at (904) 256-7555

This research is being conducted under the direction of Dr. Teri Chenot, Faculty, Jacksonville University, and has been reviewed and approved by the Jacksonville University Institutional Review Board (JU IRB #2022-076)."

Appendix H

Pre-Survey

Perceived Stress Scale-10

The Perceived Stress Scale-10 that will be given as the pre- and post-test to evaluate the effectiveness of HeartMath in reduced perceived stress levels.

What is your 4-digit code? _____

What is your gender?

Female

Male

Choose not to say

Which undergraduate nursing program is the participant is enrolled in?

___ Traditional

___ 12-month accelerated

___ 16-month accelerated

___ Re-entry program

What yeat student are you?

Freshman

Sophomore

Junior

Senior

Perceived Stress Scale

A more precise measure of personal stress can be determined by using a variety of instruments that have been designed to help measure individual stress levels. The first of these is called the **Perceived Stress Scale**.

The Perceived Stress Scale (PSS) is a classic stress assessment instrument. The tool, while originally developed in 1983, remains a popular choice for helping us understand how different situations affect our feelings and our perceived stress. The questions in this scale ask about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer fairly quickly. That is, don't try to count up the number of times you felt a particular way; rather indicate the alternative that seems like a reasonable estimate.

For each question choose from the following alternatives:

0 - never 1 - almost never 2 - sometimes 3 - fairly often 4 - very often

- _____ 1. In the last month, how often have you been upset because of something that happened unexpectedly?
- _____ 2. In the last month, how often have you felt that you were unable to control the important things in your life?
- _____ 3. In the last month, how often have you felt nervous and stressed?
- _____ 4. In the last month, how often have you felt confident about your ability to handle your personal problems?
- _____ 5. In the last month, how often have you felt that things were going your way?
- _____ 6. In the last month, how often have you found that you could not cope with all the things that you had to do?
- _____ 7. In the last month, how often have you been able to control irritations in your life?
- _____ 8. In the last month, how often have you felt that you were on top of things?
- _____ 9. In the last month, how often have you been angered because of things that happened that were outside of your control?
- _____ 10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

Appendix I

Reminder Emails

Hello HeartMath study participants!

Just a reminder, keep using the HeartMath device and technique daily! For any questions or concerns, please email The DNP Project Lead, Melissa Nelsen, at mnelsen1@jacksonville.edu or the DNP Project Faculty Chair, Dr. Teri Chenot, at tchenot@ju.edu

If you are experiencing high levels of stress and/or anxiety, please visit the JU Student Counseling center website for information on making an appointment during normal business hours at <https://www.ju.edu/counseling/>. If you have an emergent issue during off hours and weekends, you may also use our Telehealth for Jacksonville University Students (thevirtualcaregroup.com)

Thanks again for your continued participation!

Appendix J**Post-Survey****Perceived Stress Scale-10**

The Perceived Stress Scale-10 that will be given as the pre- and post-test to evaluate the effectiveness of HeartMath in reduced perceived stress levels.

What is your 4-digit code? _____

What is your gender?

Female

Male

Choose not to say

Which undergraduate nursing program is the participant is enrolled in?

___ Traditional

___ 12-month accelerated

___ 16-month accelerated

___ Re-entry program

What yeat student are you?

Freshman

Sophomore

Junior

Senior

How often did you practice the technique

Daily

Greater than 3 days a week

Less than 3 days a week

Rarely

Perceived Stress Scale

A more precise measure of personal stress can be determined by using a variety of instruments that have been designed to help measure individual stress levels. The first of these is called the **Perceived Stress Scale**.

The Perceived Stress Scale (PSS) is a classic stress assessment instrument. The tool, while originally developed in 1983, remains a popular choice for helping us understand how different situations affect our feelings and our perceived stress. The questions in this scale ask about your feelings and thoughts during the last month. In each case, you will be asked to indicate how often you felt or thought a certain way. Although some of the questions are similar, there are differences between them and you should treat each one as a separate question. The best approach is to answer fairly quickly. That is, don't try to count up the number of times you felt a particular way; rather indicate the alternative that seems like a reasonable estimate.

For each question choose from the following alternatives:

0 - never 1 - almost never 2 - sometimes 3 - fairly often 4 - very often

- _____ 1. In the last month, how often have you been upset because of something that happened unexpectedly?
- _____ 2. In the last month, how often have you felt that you were unable to control the important things in your life?
- _____ 3. In the last month, how often have you felt nervous and stressed?
- _____ 4. In the last month, how often have you felt confident about your ability to handle your personal problems?
- _____ 5. In the last month, how often have you felt that things were going your way?
- _____ 6. In the last month, how often have you found that you could not cope with all the things that you had to do?
- _____ 7. In the last month, how often have you been able to control irritations in

your life?

- _____ 8. In the last month, how often have you felt that you were on top of things?
- _____ 9. In the last month, how often have you been angered because of things that happened that were outside of your control?
- _____ 10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?