A STUDY TO EXAMINE THE FEASIBILITY OF AN INTEGRATIVE APPROACH TO INTERVENTIONS IN REDUCING ANXIETY

by

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ABSTRACT

Background: Magnetic resonance imaging (MRI) related anxiety is a multidimensional phenomenon with symptoms that include claustrophobia, fear of being hurt, fear of the unknown, and fear about results, and often causes patients to move during their MRI examination resulting in motion artifacts leading to the need for repeat scans and translating into poor quality of care, increasing costs, and declining workflow efficiency. Although most facilities performing MRIs use various techniques in an attempt to reduce anxiety, new interventions are needed to improve patient support.

Objective: The purpose of this feasibility study in patients undergoing MRI was to (1) determine recruitment rates; (2) determine adherence to touch and foot massage interventions; (3) determine provider and participant’s acceptability of physical presence, human touch or foot massage interventions; and (4) examine the effects of touch or foot massage interventions as compared to physical presence during MRI on anxiety.

Methods: A quasi-experimental design was used for this feasibility study where the interventions were foot massage and touch. For the control group, the researcher remained in the room with the patient. Recruitment of the sample (N=60) was done from the Center for Neurosciences (CNS). In addition to measuring provider and participant acceptability, anxiety was assessed using a single item verbally administered anxiety rating (VAR) scale.

Results: Recruitment of participants from the CNS generated a recruitment rate of 78.2%. There were no barriers to the application of the intervention protocol. The overall mean value of effectiveness was 8.53, SD = 2.4. There was a significant difference among the three groups in terms of effectiveness of the intervention F=15.19(2, 57), p < .001. The MRI technologist felt that these interventions were helpful to the participants in keeping them calm and they did not
disrupt the workflow or increase or decrease the length of the scan. Multilevel Modeling analysis revealed that the foot massage intervention had a significant contribution in the model ($\beta = -1.35$, SE=.63, p<0.01). Effect of the touch intervention was not significant.

**Conclusion:** The use of foot massage or touch is feasible in the MRI setting. Patients’ comments indicate acceptability of an integrative approach to interventions.
CHAPTER 1: INTRODUCTION

In today’s healthcare, diagnostic imaging plays an important role in diagnoses of illness. There has been a significant increase in use of highly advanced diagnostic imaging tools such as Magnetic Resonance Imaging (MRI), Computed Tomography (CT), Positron Emission Tomography (PET) and Ultrasound (US). These imaging technologies are highly complex and technical, demanding skilled medical technicians whose main focus is the accurate diagnosis of disease rather than the integrative approach to care of the patient (Munn & Jordan, 2011). Integrative care reconceptualizes health as more than simply the absence of disease; rather, it includes physical, mental, and social dimensions that have been largely ignored by the medical community at large (Simons-Morton, McLeroy, & Wendel, 2011). The purpose of this research is to highlight the need for a comprehensive, integrative approach to patient care in the context of MRI-based diagnoses of disease.

MRI is an indispensable, valid, reliable diagnostic tool for examining structural pathology (Harris, Cumming, & Menzies, 2004). Usage of MRI for diagnostic imaging has increased from 22 million scans in 2002 to 32 million MRI scans in 2011 (Ferreira et al., 2014). In the United States (U.S.) alone, there were 91.2 MRI scans per 1,000 population in 2009 (Cooperation & OECD, 2011).

Using a magnetic field and radio frequency pulses, MRI scanner produces cross-sectional images of the body structure being examined. The strength of the magnetic field of an MRI is measured in Tesla (T) and is directly related to image quality. Low-field MRI is under 0.2T, mid-field MRI ranges from 0.2T to 0.6T and high-field MRI has a magnetic field strength of 1.0T and higher. Unlike other diagnostic imaging devices, MRI does not use ionizing radiation and produces superior soft tissue contrasts, increasing its utility in the diagnosis of neurological,
cardiovascular, musculoskeletal, and oncological diseases. Despite these advantages, the MRI scanner itself can lead to claustrophobia and anxiety in some patients perhaps due to the confined space, limited movement, and loud noise in the scanner (Dewey, Schink, & Dewey, 2007). Claustrophobic reactions are reported in 5-10% of patients (Katz et al., 1994). Moderate to severe anticipatory anxiety is experienced by about 37% of all patients undergoing this examination (Katz et al., 1994; Quirk, Letendre, Ciottone, & Lingley, 1989a; van Minde, Klaming, & Weda, 2013).

**State and Trait Anxiety**

Anxiety is a feeling of uneasiness about an imminent state or event. State and trait anxiety are two forms of anxiety. While trait anxiety is a personality characteristic or inherited behavior, state anxiety is a feeling of uneasiness about an anticipated specific event or situation (Endler & Kocovski, 2001). Cognitive-worry and autonomic-emotional are two main facets of state anxiety, while trait anxiety is identified by the presence of anxiety in four main areas: social evaluation, physical danger, ambiguous and daily routines (Endler & Kocovski, 2001). Anxiety manifests in form of physical and psychological symptoms. Physical symptoms include, but are not limited to, palpitations, shortness of breath, hyperventilation, dryness in mouth, stomach cramps, sweating, an increased urge to void, feeling of tightness in chest and tremors. Agitation, tension, fear of losing control, irritability, and feelings of being detached are some of the psychological symptoms (Endler & Kocovski, 2001).

**Interventions to Address Anxiety**

Various pharmacological and non-pharmacological interventions have been used to address anxiety. Treatment of anxiety usually involves anxiolytic medications with or without psychotherapy (Heuzenroeder et al., 2004). Cognitive behavioral therapy (CBT) has been found
to be the most effective and cost-effective intervention for generalized anxiety disorders as compared to the pharmacological interventions (Heuzenroeder et al., 2004).

An educational program on yoga-based intervention that included yoga poses, relaxation techniques, individualized counselling, education on philosophy of Yoga and its importance in every day’s life along with the information on nutrition and information about illnesses significantly decreased state and trait anxiety within a period of 10 days (Gupta, Khera, Vempati, Sharma, & Bijlani, 2006). Use of anxiety management training (that included relaxation training, distraction and rational self-talk) and psychotherapy have been studied in treating social anxiety (Gillian, Anne, Mary, Peter, & Michael, 1984). A single application of massage therapy is effective at reducing state anxiety and repeated treatments are effective in decreasing trait anxiety at a rate similar in magnitude to psychotherapy (Moyer, Rounds, & Hannum, 2004).

Davis and Thaut (1989) studied the influence of preferred music on measures of state anxiety. The results revealed that across trials, the state anxiety decreased significantly and relaxation increased with the use of preferred music from pre to posttest conditions consistently (Davis & Thaut, 1989). Literature indicates that both muscle relaxation training and relaxing music significantly decrease state anxiety but neither decreases trait anxiety (Stoudenmire, 1975).

In the current study, I examined the effects of the intervention on state anxiety and will exclude individuals diagnosed with trait anxiety, as they may be taking anxiolytic medications that will confound the results of the study. Additionally, as will be illustrated below, the MRI environment has been shown to induce anxious reactions in individuals with no history of psychological illnesses, leading to significant hospital and patient costs.
Statement of the Problem

MRI-related anxiety is a multidimensional phenomenon and includes claustrophobia, fear of getting hurt, fear of suffocation, fear of the unknown and fear about results (Katz, Wilson, & Frazer, 1994). Patients are required to stay still during MRI examination, but one observed symptom of anxiety has been the loss of self-control. Because of MRI-related anxiety, patients might lose self-control and move their legs unintentionally or cough. Unintentional motion such as coughing and shifting legs during the exam results in image degradation/motion artifacts (Ali, Modic, Mahmoud, & Jones, 2013; Murphy & Brunberg, 1997). The imaging sequence may have to be repeated because of these artifacts, increasing the length of the scan and patient time in the scanner, while decreasing scheduling accuracy and workflow efficiency (Ali et al., 2013).

Moderate to severe anticipatory anxiety is experienced by about 37% of all patients undergoing this examination (Katz et al., 1994; Quirk, Letendre, Ciottone, & Lingley, 1989a; van Minde, Klaming, & Weda, 2013). Self-reported anxiety is usually highest with the first MRI scan but decreases with subsequent scans (Chapman, Bernier, & Rusak, 2010). Female patients, individuals in pain during MRI, patients taking anxiolytic medications before MRI, and those reporting being claustrophobic have reported higher pre-scan anxiety (Katz et al., 1994). Within an MRI session, the highest anxiety levels have been reported at the beginning and end of the MRI scan (Chapman et al., 2010). Estimations of terminated sessions due to anxiety have ranged from ~2% (Chapman et al., 2010) to 5% (Murphy & Brunberg, 1997). With an average cost of $500 (Murphy & Brunberg, 1997), the national annual net loss reaches $320,000,000 if about 2% of MRI scans have to be terminated because of anxiety. Moreover, the need to repeat terminated scans additionally burdens already strained staff and equipment time.
These financial costs are significant, but still do not take into account the emotional and mental toll on patients who suffer anxiety during a scan but do not terminate the session. Although it would be difficult to assign a number to this type of intangible cost, there are estimates of the prevalence of anxiety accompanying MRI scans. One survey of radiographers found that 71.6% reported that patient anxiety was an issue for MRI scans (Tischler, Calton, Williams, & Cheetham, 2008). Of significant concern are the patients whose anxiety causes them to refuse a repeat MRI-scan, potentially costing them accurate diagnosis and adequate medical care that have become central benefits of MRI use (Murphy & Brunberg, 1997).

**Interventions to Address MRI-related Anxiety**

The problems associated with MRI-related anxiety have compelled many researchers to identify and test potential interventions that might alleviate anxious symptoms in patients and improve image quality and patients’ MRI scan experience. These studies are typically done in hospital settings or MRI centers where patients in an intervention group are compared to a control group that receives basic information about the MRI procedure (i.e., the standard protocol for MRI patients). The range of extant interventions is surprisingly vast, and even more observational studies exist that did not specifically set out to address anxiety. These studies deliver interventions individually or in combination with one another and report various outcomes, such as anxiety, patient comfort, completion rates, and motion artifacts. The sections below will provide a detailed overview of these intervention studies, along with brief conclusions for their use in addressing MRI-related anxiety.

**Sedation**

Sedation is a common, effective pharmacological intervention to alleviate MRI-related anxiety. A study by Murphy and Brunberg (1997) in a university hospital reported that 14.3% of
patients (N=939) required sedation in a random seven-week period in order to tolerate and complete their MRI examination. Various sedation types were used, such as oral sedation, intravenous sedation, or general anesthesia. The greatest need for sedation was in women, patients undergoing head scans, and in patients who had prior MRI examinations. The successful application of sedation as an intervention must be safe, effective and efficient (i.e., the patient wakes quickly after the MRI examination) (Bluemke & Breiter, 2000).

However, sedation comes at a cost. Licensed health care professionals must administer sedation, and also must perform a review of systems, history of medical illnesses, and a brief physical assessment. Intravenous sedation is invasive and requires a catheter to be placed to administer the sedatives. Timing of sedation is a factor, as the MRI suite has to be available as soon as patient is appropriately and adequately sedated. Monitoring equipment is required, so that patients can be monitored from the onset of sedation until he/she recovers after the procedure. Dosage for sedation may vary among individuals for its maximum effect and hence recovery time may also vary. Patients requiring deeper sedation might require a longer recovery time, and patients requiring any type of sedation are not permitted to drive to or from their appointment, adding to the inconvenience for the patient. Sedation may also cause adverse effects, resulting in the patient spending more time in the unit (Murphy & Brunberg, 1997).

Non-Pharmacological Interventions

Alternatively, various non-pharmacological interventions to decrease MRI-related anxiety have been studied. Non-pharmacological interventions tend to fall into four general categories: 1) manipulation of characteristics of the MRI scanner (Bangard et al., 2007; Enders et al., 2011; Hunt et al., 2011; Price, De Wilde, Papadaki, Curran, & Kitney, 2001); manipulation of the patient placement in the scanner (Eshed, Althoff, Hamm, & Hermann, 2007; McIsaac,
manipulation of information provided to patients (Ali et al., 2013; Caruso et al., 2006; Grey, Price, & Mathews, 2000; Quirk, Letendre, Ciottone, & Lingley, 1989b; Selim, 2001; Törnqvist, Månsson, Larsson, & Hallström, 2006; Youssefzadeh et al., 1997); and manipulation of sensory input (Lang, Ward, & Laser, 2010; Redd, Manne, Peters, Jacobsen, & Schmidt, 1994; Schellhammer, Ostermann, Krüger, Berger, & Heusser, 2013; Slifer, Penn-Jones, Cataldo, Conner, & Zerhouni, 1991; Walworth, 2010). They vary in terms of participant and provider burden, cost and ease of implementation and effectiveness. The sections below provide a brief description of the category definitions and applications in the MRI setting, and then summarize findings of intervention studies conducted to address patient anxiety.

**Manipulation of the MRI scanner.** MRI scanners come in two main designs: open and closed-bore. Open MRI scanners are less confined, with only two flat magnets placed above and below the bed. Patients experience less anxiety in wide bore or open system scanners than in traditional closed bore scanners (Murphy & Brunberg, 1997). However, this method is limited because the magnetic field has less strength (0.2 - 1.0T) and produces inferior images in comparison to traditional closed-bore MRI scanners. The closed-bore MRI scanner is a cylindrical tube surrounded by a large circular magnet (ranging from 0.2 - 3T). A patient undergoing MRI in this type of scanner is positioned on a narrow bed that slides into the scanner tube. This small, confined environment with a limited field of vision may be uncomfortable on its own, but patients in closed-bore scanners are also subject to the loud noise produced during the scan that can reach up to 130dB. This noise level is equivalent to a jet-engine at take-off. The increase in acoustic noise level is primarily due to the trend toward the use of more powerful scanners (Price et al., 2001). Although high-strength (e.g., 3T) MRI equipment produces better
quality images in a shorter period than their lower-strength counterparts, the increased noise level and confined space may cause patient discomfort and anxiety (Counter, Olofsson, Grahn, & Borg, 1997; Quirk et al., 1989a).

Open MRI scanners are less confined than the closed-bore scanners. In general, studies reporting on anxiety or claustrophobic events report positive results using an open- or wide-bore scanner (Bangard et al., 2007; Enders et al., 2011; Hunt et al., 2011). Two such studies using open-bore MRI scanners (Bangard et al., 2007; Enders et al., 2011) examined rates of patient anxiety, acceptability, completion rates, and motion artifacts. Bangard et al. (2007) recruited highly claustrophobic patients and a group of non-claustrophobic patients, most of whom had previous experience in closed-bore scanners. Participants were asked to complete another scan in an open-bore MRI scanner and termination rates, anxiety, pain, and motion artifacts were measured. Among highly claustrophobic patients, terminated sessions decreased significantly, from 58.3% in the closed-bore scanner to only 8.3% in the open-bore scanner ($p < 0.001$). Patient anxiety, measured using a visual analogue scale ranging from 0-100, also significantly decreased from 87.1% (closed-bore) to 30.4% (open-bore; $p < 0.001$). Interestingly, claustrophobic events did not appear to influence motion artifacts or image quality (Bangard et al., 2007).

A similar study recruited participants who had reported fear or claustrophobia in MRI scanners and assigned them to two matched groups: the first group used a short-bore (i.e., a shorter bore length) scanner and the second used an open-bore scanner (Enders et al., 2011). The primary outcome measured was claustrophobic events (i.e., the participant could not complete the session). The results showed that there were fewer claustrophobic events in the open-bore condition relative to the short-bore condition (23 vs. 33, respectively; $p = 0.08$). However, these events still represented over 25% of the participants in each sample group and the authors
interpreted this as reflecting the high-risk population under investigation. This shows that there are other aspects of MRI scan, beyond just the feeling of being in a confined space that contribute to patient anxiety (Enders et al., 2011).

Hunt et al. (2011) examined whether the use of a short- (e.g., a shorter bore length) and/or wide-bore (e.g., 70cm, 1.25m long cylindrical) scanner decreased claustrophobic events in patients who were not able to previously complete the MRI scan in a scanner that has a smaller (e.g., 60cm) bore (Hunt et al., 2011). This study showed some positive results. It measured the number of reported claustrophobic events, patient sedations, and completed scans, and found that 50 (89%) of 56 patients were able to complete their MRI examination. Only six patients reported feeling claustrophobic and needed sedation. Across all these studies (Bangard et al., 2007; Enders et al., 2011; Hunt et al., 2011), completion rates increased, claustrophobia decreased, and overall satisfaction increased. However, the generalizability of these findings may be limited because the studies were conducted using patients from specific populations (i.e., known claustrophobic patients).

Although open MRI scanners are more cost effective, have the advantage of permitting access to the patient, do not cause feelings of claustrophobia, and are preferred for scanning children, the disadvantage of using this scanner is that scanning duration may be longer because of its low magnetic field, which may increase the risk of image degradation due to motion artifacts (Hailey, 2006; Loew, Kreitner, Runkel, Zoellner, & Thelen, 2000). Another disadvantage is that for cases where it is important to detect minute morphological changes in brain and spine tissue, high field closed MRI scanners are preferred for brain and spine imaging by many MRI centers (Hailey, 2006; Merl et al., 1999).
Manipulation of patient placement in the MRI scanner. Some researchers have examined whether patient position in the scanner influences MRI-related anxiety. One study showed that participants terminated fewer scans performed in the prone position (0.31% in breast scans) compared to the supine position (1.73% in head and neck exams). However, this finding is confounded by the fact that supine scans and prone scans are used for different parts of the body (e.g., breast versus everything else, respectively) and may reflect the average (i.e., non-scanner-related) anxiety level in response to specific health conditions affecting those areas (Eshed et al., 2007). Prone positioning is impractical for many scans (Munn & Jordan, 2013).

Additionally, although not specifically intervention studies, some researchers assessing MRI-related anxiety have observed that participants respond differently to entering the scanner head-first versus feet-first. A study by McIsaac et al. (1998) reported higher anxiety among patients entering head-first (e.g., head or upper body MRI scans) in the bore than the patients inserted feet-first (e.g., lower body MRI exam) (McIsaac et al., 1998). However, a recent study reported no difference in self-reported anxiety regardless of entering head-first or feet-first (Thorpe et al., 2008).

Manipulation of information provided to patients. Many studies have attempted to decrease MRI-related anxiety by providing additional information to patients before and/or during their MRI scans. Various approaches have been taken, including providing verbal and written information (e.g. instructions), cognitive coping strategies, and relaxation techniques. In a study by Ali et al. (2013), the total number of repeated sequences related to motion artifacts significantly decreased in an intervention group that read an educational pamphlet before their MRI examination compared to a control group that read only routine information (52 vs. 27,
Use of an education pamphlet is a fairly simple and inexpensive intervention. However, these researchers did not evaluate anxiety directly.

In a randomized controlled trial (Selim, 2001), an experimental group received supplemental written and verbal instructions that provided additional information about the MRI-scan process and the scanner itself (e.g., structure, features, and functions) and also included descriptions of relaxation techniques such as using imagery and breathing techniques to manage anxiety while the control group received the routine information. Anxiety was measured both before and after the MRI examination using the State-Trait Anxiety Inventory (STAI). The experimental group’s anxiety levels were significantly reduced compared to the control group, such that the patients of the former experienced mild to moderate state anxiety ($M=43.97$, $SD=7.34$) while 60% of the control group experienced severe anxiety ($M=61.34$, $SD=8.85$; $t(58)=10.42$, $p=0.0001$).

Youssefzadeh et al. (1997) followed a similar structure to Selim (2001), but instead measured the number of premature terminations due to anxiety. The sample in this case consisted of breast magnetic resonance imaging (MRM) patients, as well as a control group of non-breast MRI patients. There were three groups. The MRM patients ($N=336$) were randomly assigned to two groups: one receiving a detailed verbal explanation, and the other receiving the standard information consisting of a pamphlet on the procedure and a description by the radiographer; the third group was the control group which had patients with non-breast MRI scans. The detailed verbal explanation stressed the additional benefits of MRM relative to standard mammography and explained the function of the MRI machine. These patients were also told about the duration of the MRI session and sources of possible discomfort were discussed. During the procedure, the radiographer and radiologist conversed with the patients, and suggested relaxation techniques.
Furthermore, the patient was reassured that he or she could terminate the session at any time and that the radiographer would be available for visual and auditory contact. The results of this study showed a very low termination rate for the control group (0.5%), while the detailed information group completed all of their sessions without interruption; however, this difference was not significant. Among MRM patients, 5.5% of patients terminated their sessions due to anxiety, and this rate was significantly higher than the control group \( (p = 0.01) \) and the detailed information group \( (p = 0.01) \) (Youssefzadeh et al., 1997).

On the other hand, Törnqvist, Månsson, Larsson, and Hallström (2006) provided detailed written instructions to an experimental group that did not show a decrease in anxiety levels relative to a control group that received basic instructions. Moreover, a statistically equivalent percentage of the control and experimental groups interrupted the scan to receive sedation. There was, however, a reduction in motion artifacts for the intervention group (4% compared to 15.4% for the latter, \( p = 0.003 \)) (Törnqvist et al., 2006). It is possible that the ineffectiveness of this manipulation (at least in terms of anxiety) is due to the written format, as both Selim (2001) and Youssefzadeh et al. (1997) employed verbal supplementary information. However, a study by Grey, Price, and Mathews (2000) also provided written information to an experimental group and did observe a reduction in mid-scan and post-scan anxiety. Their information booklet used a large type and cartoon illustrations and offered details about the procedure and relaxation techniques. They were also given a brief tour to the control room in order to give patients a sense of spatial orientation during the procedure. Thus, it may be that the format of written information is an important factor for reducing anxiety (Grey et al., 2000).

Other researchers have combined the provision of extra information with psychological support, such as counseling, relaxation, cognitive training, and anxiety reduction training.
One such study (Caruso, Bongiorno, Vallini, Russo, Romao, Grandinetti, 2006) provided a 45-minute session with a psychologist to an experimental group prior to their scans. The goals of the session were to help patients feel welcome and that their concerns were heard; to increase their understanding of the process; to assess the effects of receiving the process information; to assist with patient expression of anxiety and making requests; and to address fears during the procedure. This experimental group did show a reduction in anxiety after the exam relative to the control group which received basic information, but they also had higher levels of somatized anxiety and depression before the scan (perhaps due to being more in touch with their emotions after the psychological session). However, it is not clear whether this is a cost effective method of reducing anxiety, financially or in terms of time.

Unfortunately, a study that employed a more cost effective strategy by providing very short counseling sessions (~5 minutes), as well as information, did not show the positive outcomes reported by Caruso et al. (2006). It did, however, show that guided relaxation significantly decreased state anxiety following the MRI procedure. This intervention was more effective than both the information-only and information-plus-counseling conditions in reducing patient anxiety (Quirk et al., 1989b). Other studies have shown similar results with guided relaxation, such as Lukins, Davan, and Drummond (1997), which showed that practicing relaxation techniques decreased anxiety both before and during an MRI scan ($p < .05$) compared to a control group. Interestingly, they also found that there was no difference in self-reported anxiety between participants who practiced guided relaxation prior to and during the scan and participants who did so only before the scan (Lukins, Davan, & Drummond, 1997). Another study by Thompson and Coppens (1994) showed that guided imagery/relaxation introduced prior to the scan was effective in reducing pre-MRI anxiety and, although not significantly different,
less anxiety post-scan than a control group that did not receive guided imagery training. Additionally, subject- and operator-reports showed reduced movements during the scan among the experimental patients compared to controls (Thompson & Coppens, 1994).

Finally, one study attempted to use hypnotic relaxation to reduce non-completion rates. Lang, Ward, and Laser (2010) provided intensive training in rapport and hypnotic relaxation (17 hours of training) to half of the health care professionals involved in MRI scans. Clerical staff also received training in rapport skills (8 hours of training). The training in rapport skills was a necessary prerequisite for the successful application of hypnotic-relaxation techniques. It involved building confidence, validation of the patient, adapting to the patients’ preferences in verbal or nonverbal communication and mode of perception (e.g., visual, auditory, or kinesthetic), decoding eye contact and movement, and usage of suggestive terms, among others. The hypnotic training covered the nature of hypnosis, induction, deepening, reorientation, and posthypnotic suggestions, as well as extensive practice with several possible scenarios. Unfortunately, due to organizational changes extrinsic to the study, training of remaining staff was not completed and the trained employees became more concerned with their job security than with the application of these techniques. However, the data that were available showed that non-completion rates decreased relative to the pre-training quarter of operation from 1.2% of 6,654 patients to 0.74% of 7,008 patients. Non-completion rates of the most anxious patients who requested the open scanner also decreased from 3.43% of 1,078 patients to 1.45% of 1,098 patients. After employee adherence to the hypnotic relaxation techniques dwindled (because of the organizational changes), non-completion rates increased to 1.13% of 6,798 patients across all scanners and 3.04% of 1,085 patients on the open scanner. Once the organizational changes had steadied, the non-completion rates decreased again. Thus, this “naturalistic” study indicates that
Guided relaxation in the form of hypnotic relaxation may be effective in reducing non-completion rates (Lang et al., 2010).

**Manipulation of sensory input.** Much of patient anxiety is a response to their sensory perception of the environment in the MRI scanner. Loud noise and confined space are two of the major contributors to MRI-related anxiety. With this in mind, staff in several MRI units has offered patients the opportunity to use headphones or even watch movies using a mirror in the scanner in the interest of improving image quality and completion rates. Others have explored the manipulation of sensory perception as a method to improve patients’ experience and decrease anxiety. Sensory modalities, such as audition and olfaction, have already been studied to alleviate MRI-related anxiety. These methods will be reviewed and a novel, kinesthetic manipulation will be introduced as a complementary or alternative therapy for MRI-related anxiety.

Manipulation of auditory perception has been studied empirically as an intervention to reduce patient anxiety and improve image quality and completion rates. Slifer, Penn-Jones, Cataldo, Conner, and Zerhouni (1991) offered patients the opportunity to listen to pre-recorded music through headphones and found that fewer patients in this experimental group reported extreme worry during their scan relative to a control group that did not receive the music option. Although no patients in either group terminated their session, participants in the music group reported less nervousness during the scan and fewer symptoms of anxiety and physical symptoms after the scan (Slifer et al., 1991). However, a more recent study found no difference in anxiety reduction between patients who wore earplugs and patients who selected and listened to pre-recorded music during their scan (Simpson, 2000).
Following this line of research, Walworth (2010) provided live music therapy to an experimental group while a control group listened to recorded music. This choice of manipulation is interesting because it permits the patient an additional degree of control by requesting specific songs or genres (e.g., similar to listening to recorded music), but also a sense of connection with and support from the musician, which is an important predictor of anxiety among patients (Tornquist et al., 2006). The study assessed the number of repeated scans (due to movement), the number of breaks requested, the length of time to complete the scan, patient anxiety, and patient perception of the experience. Results showed that experimental patients had fewer repeated scans (26% of scans vs. 73% for controls), requested fewer breaks (2% of experimental patients vs. 17.6% of controls), took less time to complete their scan (4.63 fewer minutes for lumbar scans and 5.8 fewer minutes for brain scans), and showed a greater rate of anxiety reduction compared to the control group (Walworth, 2010).

Within the last five years, researchers have also begun exploring the use of aromatherapy in medical settings. The rationale for exploring olfactory interventions has been based on early studies, such as Lorig and Schwartz (1988), which showed changes in electroencephalogram (EEG) theta waves following the administration of various odorants. This kind of observed brain activity has been associated with mood, emotion, and anxiety (Lorig, Schwartz, Herman, & Lane, 1988). Additionally, participants in this study reported lower anxiety and less tension post-administration.

Two studies examined whether administering fragrances purported to be pleasant and relaxing during MRI reduced anxiety in patients. Redd, Manne, Peters, Jacobsen, and Schmidt (2010) examined whether fragrance administration using a computerized delivery system (with separate lines for fragrance and air) decreased MRI-related anxiety. Fifty-seven patients were
randomly assigned to receive either a vanilla-like scent ($N=20$) or humidified air ($N=37$) using a nasal cannula. Using a visual analog scale (VAS), participants reported their most, least, and average levels of anxiety during an MRI scan, as well as state anxiety before and after the completion of the scan. Results showed no significant difference in state anxiety, and no effects on physiological measures such as heart rate and blood pressure. Overall, self-reported average levels of anxiety during the scan reduced significantly in the group receiving heliotropin (47% decrease in experimental patients vs. 5% decrease in control patients), but this effect was restricted to patients who rated the fragrance as pleasant (Redd et al., 1994). Thus, the successful application of this intervention may require some degree of personalization where patients select among various scents to identify their preferred odor. A more recent study by Schellhammer et al. (2013) examined whether administering aromas to MRI patients influenced mood states, such as positive mood and fatigue, as well as motion artifacts. However, they did not find any significant differences in these mood measures, nor in the severity or presence of motion artifacts (Schellhammer et al., 2013). Although this area requires further study, one must question the clinical feasibility of this intervention, as the use of additional hardware to deliver the scents and apparent need for personalization may not be cost- or time- effective.

Thus far, several interventions have been reviewed, including providing patient information, using open-versus closed-bore scanners, manipulation of the patients’ position in the scanner, and the manipulation of sensory input. The studies described have varied in successfully reducing patient anxiety during MRI procedures, suggesting that existing interventions are not sufficiently addressing the population of patients undergoing MRI who experience anxiety, fear, and claustrophobic reactions. Moreover, radiographers have reported that disruptions of scans due to anxiety are still prevalent, despite the use of information
provision, music, communication with radiographers, and sedation (Tischler et al., 2008). Tischler et al. (2008) concluded that there is a need for more patient support in order to improve patient experiences and lower the costs of disruptions due to anxiety.

**A Body-based Approach to Reduce MRI-related Anxiety**

Complementary and alternative medicine (CAM) approaches focus on a human being as a whole and include non-traditional elements of health such as physical, psychological, environmental and spiritual (Frisch, 2001). This approach has become increasingly popular in the U.S., particularly to treat anxiety and depression (Kessler et al., 2001).

The National Center for Complementary and Integrative Health categorizes Complementary and Integrative therapy into four types: (1) whole medical systems; (2) mind/body interventions; (3) manipulative body-based systems; (4) natural products; and (5) energy therapies. Practices under alternative medical systems include homeopathy, naturopathy, and Traditional Chinese Medicine. Practices such as but not limited to meditation, music therapy, focused breathing, yoga and visual imagery fall under the mind/body intervention type. Manipulative body-based systems complementary and Integrative therapy includes practices such as cranial-sacral massage, deep muscle massage, Swedish massage, and energy therapies includes healing touch, Reiki, and therapeutic touch (Barnes, Powell-Griner, McFann, & Nahin, 2004).

Various mind body interventions such as music, guided imagery, breathing exercises, hypnosis have already been studied in MRI settings. Aromatherapy as a natural product has been studied as well during MRI. As mentioned above, interruptions still occur during MRI necessitating the need for an intervention that provides support to the patient during MRI and decreases anxiety.
One particularly effective application of complementary and integrative approaches is massage therapy, which has been shown to have various positive effects on psychological and physical symptoms of depression and anxiety. In fact, even a single application of massage therapy is effective at reducing state anxiety, blood pressure, and heart rate and repeated treatments have been shown to decrease trait anxiety and depression at a rate similar in magnitude to psychotherapy. These benefits were reported in a meta-analytic study that synthesized data across 37 studies and which examined a wide range of patients, from healthy adults to HIV-positive adolescents, and headache patients to patients with Parkinson’s disease (Moyer et al., 2004). Furthermore, the positive outcomes of massage therapy did not differ across patient characteristics. Thus, it appears that massage therapy could be a highly effective, widely applicable method to address state anxiety within the MRI setting.

Massage therapy (MT) is defined here as the manual manipulation of soft tissue for the purpose of improving health and well-being (Moyer et al., 2004). Various theories have been proposed to explain the mechanism underlying MT, and research conducted to explore how MT provides health benefits appear to support multiple causal pathways. Briefly, MT may function by interfering with pain transmission, stimulating vagal activity and therefore parasympathetic response, increasing serotonin levels, preventing fibrosis, and/or improving restorative sleep (Moyer et al., 2004). It is also possible that the interpersonal attention itself is a potential mechanism. Regardless of the mechanism(s), the data overwhelmingly support the use of massage therapy in medical settings: Moyer et al. (2004) reported that a single application of massage therapy was effective in decreasing state anxiety ($g = 0.37, p < 0.01$), blood pressure ($g = 0.25, p < 0.02$), and heart rate ($g = 0.41, p < 0.01$) and repeated treatments have been shown to
decrease trait anxiety ($g = 0.75, p < 0.01$) and depression ($g = 0.62, p < 0.01$) at a rate similar in magnitude to psychotherapy.

**Nursing Scope of Practice**

In recent years, the use of integrative approaches has increased in the U.S. Because the laws to practice integrative therapies are liberal, there has been a significant increase in the use of integrative approaches by health professionals and non-physicians (Sturm & Unützer, 2000). Nurses have also been using integrative therapies in their practice. There have been various training sessions that nurses attend such as meditation, massage, Reiki, healing touch, etc., which are being taught by nurses and non-nurses (Frisch, 2001). Since these integrative therapy practices are being taught and practiced by nurses and non-nurses, the question arises whether these practices are within the scope of nursing practice. May a nurse perform massage or does she have to be licensed to massage? Next, I will explore whether massage, as an integrative approach, is within the scope of nursing practice.

**Massage as an Integrative Approach**

Massage is classified as a manipulative/body-based therapy by The National Center for Complementary and Integrative Health. A study of 53 Boards of Nursing (BONs) in the U.S. revealed that 25 BONs, including the State Board of Arizona, had statements or positions on nursing practice related to integrative therapies. Nurses can bridge the gap between traditional, current medical therapies and complementary and integrative therapies because of the theoretical equivalence between nursing practice and the practice of complementary and alternative medicine, thereby rendering these therapies as integrative (Sparber, 2001).
Massage and Nursing Scope of Practice in State of Arizona

There are three steps in deciding whether an activity is within the scope of practice: (1) define the issue, (2) review the rules, laws, and standards, and (3) then make the decision about whether to perform the activity or not (Midgley et al., 2014). The State Board can issue disciplinary action if nurses work outside their scope of practice. It is important to follow the policies of the organization even if an activity is within the scope of nursing practice. Nurses need to have knowledge of the task and should be capable of assessing, performing, and documenting the task. Also, nurses need to complete the assigned task competently and safely (Midgley et al., 2014).

The value of massage has been historically recognized in nursing. Historically, nurses have communicated caring through touch, and touch is vital to the nurse for his/her role in healing (Grealish, Lomasney & Whiteman, 2000). It has been reported that 17 state BONs required 6 to 27 hours of instruction in massage in the nursing curriculum in 1948 (Groer et al., 1994; Jensen-Nelson, 1948). Nurses used simple massage such as back rubs as a nursing intervention for years to promote comfort (Radzyminski, 2007).

In this era of high technology, every aspect of patient treatment involves incorporating technology, leaving little or no time available for caring touch. Providing back rubs as a caring touch intervention is simply not being performed or is delegated to nurse assistants (Groer et al., 1994). Also, there are no data available on the current teaching of massage techniques in nursing curricula (Groer et al., 1994).

The Arizona State Board of Nursing does not provide any position or statement on nursing practice related to massage. However, it does provide a statement on nursing practice related to CAM therapy. In the state of Arizona, a nurse may hold dual healthcare
licensure/certification. An RN will remain an RN even if she is holding a position that does not require RN credentials. “He/she will be held to the standard of highest nursing credential…A professional, practical, or advanced practitioner who has acquired or developed a specialized knowledge base, (e.g., complimentary/integrative therapies, P.A., licensed midwife), will be held to the standard of care for the nursing credential” (AZ Board of Nursing, 2001).

Regulatory authority of the state controls the right to practice as a health care profession and establishes educational and practice requirements, thus setting professional boundaries (Radzyminski, 2007). Massage is separately licensed in many states and municipalities in the U.S. Therefore, if nurses want to practice massage they will have to comply with the regulations of their state/city/county.

The state of Arizona allows licensed individuals to provide massage therapy. According to Arizona Board of Massage Therapy, a licensed massage therapist (LMT) is required to earn 700 educational hours from an accredited school. Renewal of licenses needs to be done every two years. LMTs are also required to have 25 Continuing Education hours per year.

The Arizona Board of Massage Therapy defines massage therapy as “the manual application of compression, stretch, vibration or mobilization of the organs and tissues beneath the dermis, including the components of the musculoskeletal system, peripheral vessels of the circulatory system and fascia, when applied primarily to parts of the body other than the hands, feet and head” to promote wellness and relaxation, decrease stress, reduce pain, improve posture and offer broader therapeutic benefits. One does not need to be a licensed massage therapist to massage the hands, feet and head (Arizona Board of Massage, §324201 & §324252). However, one does need to have knowledge of different massaging strokes, how to use these strokes, and the likely candidates for massage (Meintz, 1995).
Symptom management is within the legal scope of nursing practice. Both nurses and non-nurses can use foot and hand massage as an intervention. However, when nurses use this modality as part of nursing practice, care needs to be documented in a nursing context (Frisch, 2001). For example, when a nursing diagnosis is fear or anxiety in the Magnetic Resonance Imaging (MRI) context, foot massage (FM) can be used as an intervention to relax the client while undergoing MRI. Nurses can document the diagnosis, intervention, and outcome within a standard nursing taxonomic framework. This method of documenting care using taxonomies provides a framework to help nurses justify their activities within the domain of nursing (Frisch, 2001).

Since touch reflects caring, a central nursing value, nurses should strive to include massage as an intervention in their day-to-day practice to demonstrate caring and promote well-being and comfort of the patients. However, if nurses use massage in their current practice, they need to consider the legal implications associated with this therapeutic modality. Nurses need to ask themselves whether massage is within their scope of practice, whether massage therapy overlaps with the scope of practice of another profession, whether the nurse requires additional education, training or licensure to provide massage and whether the massage applied by a nurse carries enough risk to an individual sufficient to support a malpractice or professional negligence claim.

**Purpose**

Based on this evidence showing that MT effectively reduces state anxiety, MT may help decrease MRI-related anxiety. Patients entering headfirst in the scanner experience higher levels of anxiety than the patients with their feet first in the scanner (McIsaac et al., 1998). Foot massage, then, may be a feasible, novel, and integrative intervention for these patients whose feet
are the only available body parts for MT. Also, it may be that touching the feet or the mere physical presence of the individual applying the massage helps decrease anxiety during MRI. The purpose of this study is to test the feasibility and effect of physical presence, touch and foot massage on anxiety among patients undergoing MRI. This research focuses on the feasibility of presence, touch and foot massage and their effect in reducing anxiety among individuals 21 years and older, who are undergoing MRI at Center for Neurosciences.

Although there are no studies to date examining presence, touch and foot massage as interventions in MRI settings, several have reported decreases in anxiety following the application of foot massage during hospitalization (Grealish, Lomasney, & Whiteman, 2000; Hayes & Cox, 1999) and on postoperative patients (Bauer et al., 2010; Cutshall, Wentworth, Engen, Sundt, Kelly, & Bauer, 2010; Degirmen, Ozerdogan, Sayiner, Kosgeroglu, & Ayranci, 2010; Ucuzal & Kanan, 2014; Wang & Keck, 2004). One such study employed a quasi-experimental design to examine the effects of foot massage in patients who had been hospitalized with cancer (Grealish, Lomasney, & Whiteman, 2000). Patients received massage therapy twice, lasting about 10 minutes per session (five minutes per foot), and the outcomes were also measured on an additional night that served as their own control condition. Pain, nausea, and relaxation were all measured using a visual analog scale ranging from 0-100, while heart rate was measured using a heart rate monitor. The results showed significant decreases following the intervention for pain, nausea, heart rate, and increased relaxation. Similarly, Hayes and Cox (1999) conducted a quasi-experiment using patients in critical care in order to assess the effects of foot massage on heart rate, mean arterial blood pressure, respirations, and peripheral oxygen saturation. Participants received the five-minute massage and the outcomes were measured prior to, during, and after the intervention. Results showed significant decreases in all outcomes but
peripheral oxygen saturation; however, the effects appeared to be somewhat small in magnitude and briefly effective (Hayes & Cox, 1999). Another study showed a significant effect of a 20 minute foot massage on self-reported calmness in a RCT that evaluated whether foot massage promotes feelings of well-being in patients after a coronary artery bypass graft (Hattan, King, & Griffiths, 2002). Finally, a study monitored short- and long-term effects of foot massage in patients undergoing breast surgery. A 20-minute foot massage produced a significantly higher rate of reduction in systolic and diastolic pressure in the first and second hours following foot massage compared to a control group that did not receive foot massage (Abdelaziz & Mohammed, 2014).

The current study is based on the evidence showing that MT effectively reduces state anxiety, and will extend these findings to conduct a pilot study using patients undergoing MRI. The specific application that was used included the use of touch, foot massage and physical presence during head MRI scans, where the feet are the only available body parts for MT and patient anxiety will be measured using a verbal anxiety rating scale. Touch, presence or foot massage may help individuals become less reactive to the stressors they face in the MRI suite and alter the way they experience the situation. The situation itself will not change for the individual, as the environment and stressors causing anxiety still exist, but the individual’s perception of it could change. Foot massage or touching lower legs as a distractor might direct patients’ attention to something other than the MRI machine. Instead of interpreting the situation as threatening, the experience can end up being the exact opposite - one associated with relaxation and feelings of well-being. These positive emotions not only alleviate anxiety, but improve one’s sense of well-being, even in individuals without anxiety.
Research Questions

The research questions (RQs) of this study are designed to meet two major objectives: (1) determine the feasibility of implementing integrative approaches to interventions such as human touch and or foot massage as standard protocol for MRI-related anxiety, and (2) determine whether the application of integrative interventions reduces self-reported anxiety in MRI patients. The specific research questions are described below:

RQ1): Is it feasible to recruit participants for human touch and foot massage intervention during MRI?

RQ2): Is it feasible to apply touch or foot massage intervention during MRI per protocol?

RQ3): Is physical presence, human touch and foot massage acceptable to provider and participants during MRI?

RQ4): Is there a difference in the levels of anxiety among patients receiving human touch or foot massage as compared to the physical presence during MRI?

Summary

The integrative approach to care encourages healthcare professionals to help patients develop emotional coping strategies that will keep their “wholeness” intact (Jackson, 2004). Integrative approach might help individuals not to lose self-control in MRI diagnostic imaging settings. The use of human touch or foot massage as a novel intervention may help alleviate MRI-related anxiety, demonstrate caring, and promote the well-being and comfort levels of the patients. In addition, it might help improve diagnostic accuracy and reduce hospital costs by preventing repeated scans and improving workflow efficiency.
CHAPTER 2: THEORETICAL PERSPECTIVE

This chapter will discuss the theoretical framework underpinning this research. This study was developed based on the theoretical framework developed by Lazarus and Folkman (1984) commonly called the “Lazarus Theory of Stress and Coping.” Briefly, Lazarus’ theory posits that person-environment transactions are the sources of stress. Unlike previous theories of stress that identify “events” as stressful, Lazarus emphasizes the role of appraisal (and therefore of the person). Depending on the nature of the event (i.e., what kind of threat it constitutes) and the resources available to the individual (i.e., personal or social resources), a person’s response (i.e., coping strategy) can range from attempts to confront and address the stressor to surrender to the situation and a feeling of helplessness. The major relationships identified in this framework have been used as a conceptual framework for the current study. This chapter will discuss: (1) origins of the stress and coping model; (2) major relevant concepts of the stress and coping model; (3) operationalization of concepts; (4) evidence supporting use of this model in stressful situations and in nursing studies; and (5) the application of this model in the MRI setting.

Origins of Stress and Coping Models

There is not one single theoretical framework that guides research in stress and coping. Stress and coping have been identified as important variables affecting health by different disciplines such as psychology, nursing, social psychology, and medicine. Two major theoretical orientations to stress and coping have been proposed by Selye’s response-based stress model and Lazarus’ transactional model (Lyon, 2000; Rice, 2012). The next two sections will explain the concept of stress from a physiological perspective (Selye, 1976, 1982), followed by a description of the cognitive approach (Lazarus & Folkman, 1984).
Selye’s General Adaptation Syndrome

The concept of stress was introduced into the life sciences by Hans Selye (Appley & Trumbull, 1967, 1986; Lazarus & Folkman, 1984). As a medical student in 1925, he became interested in stress after observing that many illnesses displayed similar symptoms. Selye also discovered that similar physiological changes were produced in response to a number of noxious stimuli, such as infection, trauma, hemorrhage, and even extreme temperatures. He called these changes the stress response or general adaptation syndrome (GAS), and labeled the noxious stimuli producing stress, ‘stressors.’

According to Selye, the GAS occurs in three stages: (1) the alarm stage, (2) the resistance stage, and (3) the exhaustion stage (Selye, 1950, 1979, 1982). The alarm stage is an immediate reaction to noxious stimuli in which the body reacts with a “fight-or-flight” response. This causes the release of stress hormones such as cortisol and adrenaline and helps the individual orient action in response to the stressor, sometimes even permitting the individual to be capable of activities that he or she otherwise would not be able to do. Physiological responses also include increased heart rate and blood pressure, decreased temperature, and loss of muscle tone. This is followed immediately by the resistance stage, in which the individual starts using defense systems in response to the physiological fallout of the alarm reaction. Once the individual starts showing resistance to stressors, the physiological responses associated with the alarm stage either disappear or start improving. With continuous or chronic stressors, the individual’s defense systems may eventually be exhausted. In the exhaustion stage, physiological responses associated with alarm might reappear or the individual might experience burnout, which can result in diseases or illnesses if stress overload continues. Death may even ensue once the adaptive energy is exhausted (Selye, 1979, 1982).
Limitations of Selye’s Model

First, Selye defined stress as a nonspecific response to noxious stimuli or stressors. This definition is very general and obscures more specific response components of stress. For example, there are differences in autonomic responses for anger versus anxiety, and physiological responses to anger and fear vary as well. More specifically, there are adrenergic effects in response to fear while cholinergic effects occur in response to anger. A single emotion such as anxiety can trigger different physiological responses based on how an individual adapts to it (Lyon, 2000).

Another limitation is that Selye uses the term stressor to refer to the noxious condition that triggers the response and the term stress to refer to both the initial impact of the stressor (alarm reaction) on tissues as well as the adaptive mechanisms that are a reaction to the stressor. In addition, conceptual confusion about the meaning of the term stress was heightened because Selye sometimes defined stress as the wear and tear, damage, or disease consequences of prolonged GAS responses (Lyon, 2000).

Within Selye’s model, the absence of cognitive factors such as appraisal and meaning shortchanged what occurs in psychological stress and the normative nature of the nonspecific physiological response pattern or GAS does not allow for individual differences in perception of a stimulus situation or how a person uniquely copes with a threatening situation (Lyon, 2000).

Finally, when considering the adoption of this theory to guide nursing practice, the assumptions underlying the theory are not compatible with nursing’s philosophical presuppositions, rendering its application to nursing practice awkward at best. Specifically, the presupposition that each individual is unique and that perception or meaning is central to one’s personal experiences is not compatible with Selye’s tenants (Lyon, 2000).
Because of the limited focus of the physiological perspective that framed stress in terms of fight-or-flight (Cannon, 1916) or general adaptation syndrome (Selye, 1950), Lazarus sought an alternative and found inspiration in Magda Arnold’s (1960) cognitive emotion theory that identified appraisal as a key factor in emotional responses, including stress responses. Thus, Lazarus’ early model (1966) proposed a transactional model whereby stress was a product of a person-by-situation interaction, and construed stress as a set of cognitive, emotional, and coping factors (Lazarus & Folkman, 1984; Lazarus, 1966). In both his early and later model (Lazarus & Folkman, 1984; Lazarus, 1966) the critical element determining the characterization of an event as stressful was the appraisal by the individual. His model deviated from Arnold’s in a few key ways; of relevance here is that he emphasized the cognitive and motivational antecedents of emotion (Lazarus & Folkman, 1984).

**Lazarus’ Theory of Stress and Coping**

In Lazarus’ model, stress is a product of a person-situation interaction in which an event is appraised by the person, who evaluates the situational characteristics as well as the personal resources available to cope with the situation. Stress increases when the person’s appraisal indicates that: (1) they do not have enough personal or social resources to manage the situation; (2) they do not have adequate coping strategies; or (3) the situation is determined to be harmful (i.e., the harm or loss has already taken place). Emotions arise in response to the cognitive appraisal and depend on whether the appraisal concludes an event is a challenge, threat, or harm. Health is also a product of appraisal, as it is considered a subjective construct that reflects one’s functional ability and somatic senses (Lazarus & Folkman, 1984).

It is important to note that Lazarus employs a three-term model to classify the components (Figure 1). *Antecedent* conditions include person and situation factors. *Mediating*
processes include appraisals and coping strategies. Effects include stress, emotional, or physiological changes, including physical and psychological health. Lazarus’ Theory of Stress and Coping would be categorized as a “wide” theory, meaning that its boundaries encompass a wide range of phenomena. This is in part due to its formulation as a transaction and process that is expected to occur continuously for people across a variety of contexts.
FIGURE 1. Lazarus’ Stress and Coping Model.
Central to this transactional model is the person-by-situation interaction. Situational factors are taken into account when engaging in the appraisal process, and have properties such as uncertainty, novelty, ambiguity, and timing. Lazarus described the role of the person in terms of the resources available to them. This would include one’s own history of successes or failures, as well as current commitments (e.g., goals, intentions) and beliefs (e.g., expectations of self) that orient the person toward different goals. For Lazarus’ model one’s self-efficacy and sense of control are key resources guiding responses to events (Lazarus & Folkman, 1984).

Lazarus also intended to explain how stress, emotions, and health (e.g., physical and psychological) are produced out of that process, so it has clinical applications in medicine and psychology. Lazarus defined stress as a multidimensional factor that is composed of cognitive, emotional, and coping factors. It is produced when the demands of a situation exceed a person’s available resources. Lazarus focused on stress-related emotions such as fear, anxiety, guilt, anger, and sadness. He argued for a cognitive-motivational model of emotion, wherein cognitions and motivations precede emotions. Health was construed as a kind of adaptational outcome that encompassed physical and psychological functions, including illness, cognitive ability, and morale. Under Lazarus’ model, health is subjective, in part due to the appraisal aspect of his theory (Lazarus & Folkman, 1984).

Appraisal was defined as a type of self-evaluation, and could be further distinguished into three types: primary appraisal, secondary appraisal, and reappraisal. Primary appraisal involves a judgment about a situation and an assessment of the available resources to deal with the situation. Events may be appraised as challenges, threats, or harm/loss and each appraisal produces different responses, ranging from excited anticipation in the case of a challenge to helplessness and depression in the case of harm or loss. Secondary appraisal
Coping was defined as “constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person” (Lazarus & Folkman, 1984). This formulation of coping identifies it as a process, rather than a learned behavior. The objective of coping is to manage stress arising from an appraisal by tolerating, changing, minimizing, avoiding, or accepting the stressful situation. According to Lazarus, coping strategies may be problem-focused or emotion-focused. Problem-focused coping involves changing internal or external aspects of the situation, such as by defining the problem, taking action, and learning new skills (external strategies), or changing the meaning of an event or reducing one’s personal involvement in it (internal strategies). Emotion-focused coping strategies function to reduce emotional distress, and may include use of relaxation exercises, using humor, meditating, wishful thinking, distancing, avoiding, finding social support, exercising, or meditating (Lyon, 2002). This latter form is more common when a situation is unchangeable. The current research is based on this latter form of emotion-focused coping strategies, as MRI patients have few alternatives in terms of problem-based strategies. My objective is to determine whether foot massage facilitates emotionally-based coping strategies during MRI scans.
Operationalization of Concepts

Folkman, Lazarus, Gruen, and DeLongis, (1986) evaluated the influence of cognitive appraisal (both primary and secondary) on coping processes across different stressful events/interactions in a sample of 85 married couples. Primary appraisal was assessed with a 13-item questionnaire. The items described various investments an individual might have in a specific situation/event/context (e.g., physical well-being, emotional well-being, harm to a loved one’s emotional well-being, not achieving goal at work, burden on financial sources, appearing incompetent, etc.). Participants indicated the extent of their concern about each of these factors on a 5-point Likert scale. Secondary appraisal was assessed with four 5-point items which asked the participants the extent to which they had to accept the situation, could change or do something about the situation, needed to know more before acting in the situation, or had to hold back from what they wanted to do. Coping was assessed with a 66-item revised Ways of Coping Checklist. Eight different coping scales assessed the participants’ use of coping strategies including confrontive coping, distancing, self-controlling, and seeking social support, accepting responsibility, and escape-avoidance, problem-solving and positive reappraisal (Folkman, Lazarus, Gruen, & DeLongis, 1986).

The study revealed that primary appraisal is associated with various coping responses. When the participants felt their self-esteem was at risk, they used three coping strategies predominantly: escape avoidance, seeking social support, and self-control. Also, the secondary appraisal scale responses showed that problem-focused coping was the main coping strategy used when the situation was perceived as changeable. Emotion-focused coping strategies such as escape-avoidance and distancing were used when the participants perceived the situation as unchangeable. Coping strategies were directly related to the
outcome of situation. Outcomes were satisfactory when problem solving strategies and
positive reappraisal was used. Use of distancing and escape-avoidance was associated with
the unsatisfactory outcomes (Folkman et al., 1986).

**Use of Lazarus’ Model of Stress and Coping in Nursing**

The Lazarus model has generated quite a bit of research since its inception in 1966, and is
now a cornerstone topic in psychology. A Google Scholar review reports that 48,700 authors of
published works have cited Lazarus and Folkman (1984) while 7,710 authors have cited his 1966
book. The scope of the theory draws the attention of health and psychological professionals,
including doctors, nurses, psychologists, and psychiatrists. The construct of stress is itself a
central component of most models of health, and has also permeated the fields of human
development (e.g., child development, aging), economics (e.g., inequality), business (e.g.,
burnout), and many others (Somerfield & McCrae, 2000).

With specific regard to nursing, the Lazarus model is useful for practice, education, and
research. Nurse practitioners may incorporate ideas from the model to provide better care for
their patients and educators would be remiss to exclude such a prominent theory from their
curricula. The theory provides a rich source for nursing researchers to generate hypotheses about
the role of stress in healing processes. It is clear that the theory has been employed in the nursing
field; a search in Google Scholar using the search terms ‘Lazarus' and 'nursing' produced 43,800
results. A review of the OVID Nursing Database by Lyon (2000) identified funded studies from
between 2000 and 2010 using the key words ‘stress and Lazarus’ and ‘coping and Lazarus,’ and
found 48 and 34 articles, respectively. Thus, this theory continues to have broad usage in nursing
research (Lyon, 2000; Rice, 2012).
This model has been used as a framework in various studies that examined factors causing anticipatory anxiety related to medical tests and or surgical procedures. Since this research is based on anxiety related to a diagnostic test (MRI examination), studies that applied Lazarus’ stress and coping model in cases that involved imminent anxiety related to medical tests and surgical procedures were reviewed.

An observational study by Medeiros and Peniche (2006) used Lazarus’ model to examine the relationship between anxiety and coping strategies used during the pre-operative period. This study revealed that social support and problem solving coping strategies were the most commonly used coping strategies and that these strategies had a negative relationship with anxiety levels during the pre-operative period (Medeiros & Peniche, 2006).

Orbell et al. (2004) evaluated the role of cognitive appraisal components of Lazarus’ theory in explaining emotional reactions to colposcopy following an abnormal cervical screening result. Women who went through immediate treatment at first colposcopy were less anxious than the women who deferred their treatment to a later date (Orbell, Hagger, Brown, & Tidy, 2004). Similarly, MacFarlane and Sony (1992) used Lazarus’ stress and coping model as a framework to understand anxiety levels associated with breast lump discovery. The researchers examined various factors that can alleviate or increase the level of anxiety associated with the identification of a breast lump. Delay in contacting the physician post breast lump discovery had a significant positive relationship with the anxiety level of women. Also, anxiety levels were higher prior to knowing the results of biopsy of breast lump (MacFarlane & Sony, 1992).

Intervention studies have integrated established coping mechanisms into healthcare procedures to examine their effects on anxiety levels in patients. For example, Eberhardt, Wersch, Schaik and Cann (2006) examined this model to study the effects of stress mediators
such as information and perceived social support on anxiety in male and female patients of various age groups undergoing gastrointestinal endoscopy. This study revealed that clearer information regarding the endoscopic procedure decreased anxiety. Social support also decreased endoscopy-related anxiety (Eberhardt, Wersch, Schaik, & Cann, 2006).

Hendel, Fish and Aboudi (2000) explored anxiety levels and coping strategies used by the nurses in a hospital in Israel during a national state of emergency (e.g., Iraqi crisis) using Lazarus’ model as a framework to guide their study. The nursing managers were instructed to provide social support and suggest emotional coping strategies to the nurses to help them deal with stress. Although the nurses were unable to control or remove the stressors, use of these coping strategies helped them to maintain emotional stability and improve their nursing interventions to help patients cope with the stressful circumstances (Hendel, Fish, & Aboudi, 2000).

Another study by Belleau, Hagan and Masse (2001) evaluated Lazarus’ model to assess the effects of an individualized psychocognitive educational intervention on preoperative anxiety in women awaiting mastectomies. There was a significant decrease in anxiety in the experimental group the day before surgery. These results indicate that levels of anxiety before surgery depend on cognitive perceptions of surgery as threats versus challenges, which appears to support the Lazarus stress and coping model (Belleau, Hagan, & Masse, 2001). Finally, Jefferson (2010) used the stress and coping model to examine effects of interventions such as therapeutic massage and patient teaching related to diaphragmatic breathing on blood pressure, stress, and anxiety in African-American women who suffer from hypertension and found significant decreases in anxiety and blood pressure one week post-intervention (Jefferson, 2010).
Use of Lazarus’ Stress and Coping Model in the MRI Setting

This model has been used as a framework in the current study, which examines the effect of foot massage in decreasing MRI-related anxiety. Within the framework of the Lazarus model, the experience of MRI examination may be construed as a stressor during primary appraisal and MRI-related anxiety as a stress response to the appraisal of the examination as a threat (Figure 2). Anxiety is the outcome/dependent variable in this study. Anxiety is a state of uncertainty and fear, which can result from the anticipation of a threatening situation, causing physiological and psychological changes in the body (Stedman, 2006). Anxiety during MRI scanning is a multifaceted phenomenon. Anxiety can be related to a fear of enclosed spaces, fear of being hurt, fear of the results of the test, and fear of the unknown (Katz, Wilson, & Frazer, 1994). Literature already shows that personal factors such as female gender, pain during MRI, claustrophobia, fear of the unknown and fear about results cause anxiety during MRI (Katz, Wilson, & Frazer, 1994). Apart from personal factors, environmental factors such as loud noise and confined space are two of the major contributors to MRI-related anxiety. Open MRI scanners are less confined than the closed bore scanners, but also less commonly used. Also, closed bore scanners can produce loud noise (130dB), which is equivalent to a jet engine at take-off. Higher anxiety has been reported among patients entering head-first (e.g., head or upper body MRI scans) in the bore than the patients inserted feet-first (e.g., lower body MRI exam) (McIsaac, Thordarson, Shafran, Rachman, & Poole, 1998).
To measure anxiety levels in the MRI suite, the Verbal Anxiety Rating scale (VAR) will be administered before, during, and after the MRI. Many studies have attempted to decrease MRI-related anxiety by providing additional information to patients before and/or during their MRI scans. Various approaches have been taken, including providing verbal and written information (e.g., instructions), cognitive coping strategies, and relaxation techniques. Sensory modalities, such as music therapy and use of fragrance have already been studied to alleviate MRI-related anxiety. The studies described have varied in the level of success at reducing patient anxiety during MRI procedures, suggesting that existing interventions are not sufficiently addressing the population of patients undergoing MRI who experience anxiety, fear, and claustrophobic reactions. Moreover, radiographers have reported that disruptions of scans due to anxiety are still prevalent, despite the use of information provision, music, communication with radiographers, and sedation (Tischler et al., 2008).

Various coping strategies may decrease level of anxiety, depending on how an individual appraises the MRI environment and what coping strategies are available to the patient (Lazarus & Folkman, 1987). For example, individuals who request sedation to complete MRI are likely to predict experiencing or actually experience high level of anxiety. Individuals who do not complete the scan, and are unwilling to get another MRI in the future appear to be using avoidant coping strategies. These individuals are likely to be experiencing high levels of anxiety, thereby preventing their participation in MRI scans. Use of social support coping strategies such as the presence of a family member during scanning may help some individuals complete the scan. The prediction of the current study is that use of human touch or foot massage by a qualified healthcare provider as comparison to presence during MRI may facilitate emotion-based coping strategies to reduce MRI-related anxiety.
Body-based Interventions

Body-based therapeutic interventions such as human touch and or foot massage are the independent/predictor variables in this study. Human touch and or foot massage involves manipulation of the soft tissue beneath the dermis of the feet to decrease anxiety, promote health, and relaxation. In fact, even a single application of massage therapy is effective at reducing state anxiety \((g = 0.37, p < 0.01)\), blood pressure \((g = 0.25, p < 0.02)\), and heart rate \((g = 0.41, p < 0.01)\) and repeated treatments have been shown to decrease trait anxiety \((g = 0.75, p < 0.01)\) and depression \((g = 0.62, p < 0.01)\) at a rate similar in magnitude to psychotherapy (Moyer, Rounds, & Hannum, 2004). These benefits were reported in a meta-analytic study that synthesized data across 37 studies and which examined a wide range of patients, from healthy adults to HIV-positive adolescents, and headache patients to patients with Parkinson’s disease. Furthermore, the positive outcomes of massage therapy did not differ across patient characteristics. Thus, it appears that massage therapy could be a highly effective, widely applicable method to address state anxiety within the MRI setting.

Prior studies have shown that foot massage helps reduce anxiety in hospitalized cancer patients undergoing chemotherapy treatment (Quattrin et al., 2006), and causes a significant decrease in diastolic blood pressure and anxiety levels among long-term care staff providing care to older patients with dementia (Moyle et al., 2013). These findings give support for “why” foot massage, proposed here, can be examined as a health promotion tool to decrease MRI-related anxiety. Lindgren et al. (2010) found that caring touch reduced heart rate and maintained the balance of the autonomic nervous system in healthy volunteers. This mechanism of decreasing sympathetic nervous system activity and inducing a compensatory decrease in parasympathetic nervous activity, may give support for “how” foot massage might work to promote health.
Because the literature shows that massage stimulates the skin receptors and subcutaneous tissue, which stimulate a parasympathetic response, which, in turn, results in decreased heart rate, heart rate variability, and blood pressure; anxiety scores are expected to decrease after the application of human touch or foot massage. The effects of human touch or foot massage will be assessed with self-reported anxiety using the VAR before, during, and after the scan. Use of human touch or foot massage is predicted to help individuals become less reactive to the stressors they face in the MRI suite and alter the way they experience the situation. The situation will not change for the individual as the environment and stressors causing anxiety will still exist, but individual’s perception of it may change as they perceive the environment to be less threatening with the additional resources provided by the calming effects of foot massage. Thus, touch or foot massage is expected to facilitate emotion-based coping strategies and is especially useful in situations in which one has very little ability to control the stressors causing anxiety.

Reappraisals are expected to occur continually throughout the MRI experience, and may be influenced by interventions designed to decrease MRI-related anxiety. Use of the VAR scale to assess anxiety before, during and after MRI is an example of reappraisal of MRI experience throughout MRI examination. A decrease in anxiety may indicate a reduced perception of the experience as a threat.

**Conclusion**

Health is not just the absence of disease but consists of physical, mental and social dimensions (Simons-Morton, McLeroy, & Wendel, 2011). Health promotion is the art and science of helping people to move towards optimal health. A balance of physical and mental health can be achieved through harmonious interaction with one’s physical, social, and emotional environments; and with the use of coping strategies that resist disequilibrium (Saylor, 2004).
This holistic definition of health serves as a foundation for this study’s proposed health promotion strategy, which is foot massage. By applying foot massage or touching the lower legs of the patient, focus will be on human beings as a whole and include physical, psychological, environmental, and spiritual elements of health. Theories frequently guide research processes. A growing body of evidence suggests that interventions developed with an explicit theoretical foundation are more effective than the ones lacking a theoretical base (Glanz & Bishop, 2010). The interpersonal theory of Lazarus stress and coping model, which has been used for health education, health promotion, and disease prevention (Lazarus & Folkman, 1984), provides the most appropriate framework for this research.
CHAPTER 3: METHODOLOGY

The purpose of this feasibility study in patients undergoing MRI was to (1) determine recruitment rates; (2) determine adherence to touch and foot massage interventions; (3) determine provider and participant’s acceptability of physical presence, human touch or foot massage interventions; and (d) examine the effects of touch or foot massage interventions as compared to physical presence during MRI on anxiety. This chapter describes the methodology used for this feasibility study. The first section discusses the overall design of the study, including a section on how samples were selected, the inclusion/exclusion criteria that were applied and the recruitment method used. A section describing the intervention procedures and how they were applied follows this. The remainder of the chapter presents the measures that were used, and includes a discussion of the data collection and data analysis.

“Feasibility studies are pieces of research done before a main study” (Arain, Campbell, Cooper, & Lancaster, 2010). Conducting a feasibility study is indicated in situations when researchers are making preparation to conduct a full scale research project. In this way, it is possible for a researcher to determine whether a full scale project is warranted. In addition, a feasibility study provides researcher opportunities for seeing whether any changes are needed in research methods or protocols as well as checking for any other changes that might occur especially that concern both efficacy and effectiveness of an intervention (Bowen et al., 2009).

In the case of research-supported healthcare interventions, there is a need to test whether an intervention is needed or whether it provides effective in improving health outcomes. There are situations however, when there are limitations in resources resulting in diminished possibilities for such testing. Therefore, it is helpful to have the results of a feasibility study for producing findings for determining recommendations for further research. Such research
practices support the goal of establishing interventions that are fully supported by evidence from research findings (Bowen et al., 2009).

Indications for conducting a feasibility study are: (1) studies previously published or data on a particular intervention method are scant (Bowen et al., 2009) and (2) results from prior empirical research have revealed that the susceptible population is in need of targeted interventions (Bowen et al., 2009). A search of PubMed using single citation matcher on “foot massage intervention” generated only two articles. A similar search on “foot massage” produced 40 articles, of which 10 dealt with reflexology foot massage, however, reflexology is out of the scope of this research. Radiographers have reported that disruptions of scans due to anxiety are still prevalent, despite the use of information provision, fragrance, relaxation techniques, music, sedation, etc. (Tischler, Calton, Williams, & Cheetham, 2008). Tischler et al. (2008) concluded that there is a need for more patient support in order to improve patient experiences and lower the costs of disruptions due to anxiety.

Bowen et al. (2009, p 453), reported a need for a feasibility study in light of “previous interventions [that] had positive outcomes but in different settings than the one of interest.” As previously discussed in Chapter 1, although there are no studies to date examining foot massage (FM) as an intervention in MRI settings, several have reported decreases in anxiety following the application of foot massage in other medical settings. For example, in a quasi-experimental study, a five minute FM application to critically ill patients promoted relaxation by significantly decreasing heart rate, blood pressure, and respiration rate (Hayes & Cox, 1999).

In another quasi-experimental study by Grealish et al. (2000), cancer patients reported a significant increase in relaxation after the application of a 10 minute FM session. Another study monitored short- and long-term effects of FM in patients undergoing breast surgery. A 20 minute
FM session produced a significantly higher rate of reduction in systolic and diastolic blood pressure in the first and second hours following foot massage compared to a control group that did not receive FM (Abdelaziz & Mohammed, 2014).

Bowen et al. (2009) go on to say that feasibility studies address eight areas of focus: (1) acceptability (to the participant and the researcher); (2) demand (use of the specific intervention in a defined population); (3) implementation (intervention applied per protocol; (4) practicality; (5) adaptation (changing the contents of the intervention to apply in a new setting/population); (6) integration (what system changes are needed to implement this intervention); (7) expansion (can this intervention be applied to diverse settings/population); and (8) limited-efficacy testing (any interventions that are found to lack feasibility during the feasibility study phase need to be modified or discarded and advance the interventions that are highly probable for efficacy). Conducting a feasibility study in the intervention research process delimits interventions to those that are worthy of being tested (Bowen et al., 2009).

**Research Design**

A quasi-experimental design was used for this feasibility study. There were three groups: foot massage, touch, and presence. Foot massage and touch groups were the intervention groups. To control for effects on anxiety reduction that may occur simply because someone is present at the time of the test, the researcher was in the room with the participants in the presence group (control group). There was no random assignment to groups.

**Sample**

**Setting**

This research was conducted at the Center for Neurosciences (CNS) located at 2450 East River Road, Tucson, AZ 85718. This was a free-standing facility which offers a variety of
services dedicated to the diagnosis and treatment of neurological disorders. CNS has an onsite fully accredited imaging center that houses state-of-the-art 1.5 tesla MRI unit (www.neurotucson.com). MRI examinations of head and spine are performed in this MRI suite from Monday through Saturday (M. Pazzi, personal communication, January 9, 2015). This unit is a closed-bore MRI scanner which has a cylindrical tube surrounded by a large circular magnet. A patient undergoing an MRI is positioned on a narrow bed that slides into this scanner tube. The scanner tube has a small bore with a limited field of vision. In addition to the confined environment of the MRI scanner, this unit also produces jet-engine-like loud noise. Data were collected from the patients undergoing MRI examinations of the head and or spine in this MRI unit. These patients were in the confined environment and experienced the extremely loud noise while receiving one of the three conditions: foot massage, touch or presence during the MRI.

**Sample Selection**

Initially, the plan was to limit participants to those undergoing MRI of the head to standardize the length of the scan. However, since head, neck, thoracic and lumbar region MRI scans were scheduled for almost similar length, the inclusion criteria were modified to include all individuals undergoing MRI of the head, neck, head and neck, thoracic and lumbar spine. Participants who agreed to be screened were evaluated against the inclusion criteria, which included English-speaking adults, age 21 and older, who were undergoing an MRI head, neck, head and neck, thoracic spine and or lumbar spine scan, and previously had an MRI. Also due to the nature of the study, individuals were excluded if they had psychiatric disorders such as anxiety, or were on anxiolytic medications, analgesics, or narcotics for pain, had impaired cognition, were hard of hearing, had had foot surgery, had arthralgia in the feet, open
wounds/laceration/warts or other skin conditions on the feet, or numbness or tingling in feet, or feet that bruise easily/varicose veins.

Sample Size

Repeated measures ANOVA was planned for within and between groups analysis. Sample size was calculated using PASS (Hintz, 2007). Based on the power analysis for a large effect = 0.775 at power = 95% and \( p < 0.05 \) a sample of 45 participants (15 per group) was needed. However a sample of 60 participants was recruited to avoid a problem with insufficient sample because of participants unable to complete the scan and therefore subject loss.

Measures

Patient Participants

Participants were required to complete a brief demographics survey and an assessment of their level of anxiety. The demographic survey consisted of questions asking about general characteristics such as age, sex, race/ethnicity, income, marital status, medications, reason for MRI, and any other illnesses.

Anxiety Scale

Anxiety was assessed using a single item verbally administered anxiety rating (VAR) scale. VAR is a 0-10 linear numerical rating scale where a rating of zero means no anxiety and 10 means the feeling of being terrified. The score of 5 or greater on VAR suggests anxiety. This scale has very little respondent burden. It can be administered rapidly and interpreted immediately without the need for a scoring method. It can also be used in both medical and non-medical settings (Benotsch, Lutgendorf, Watson, Fick, & Lang, 2000).

This scale has been used for repeated measures of anxiety in adult patients (n=198) before, during and after invasive procedures (angioplasty, nephrostomy). This scale significantly
predicted anxiety rating in patients during interventional radiology procedures, indicating predictive validity of VAR. In terms of convergent validity of VAR, high correlation was found between VAR and the state anxiety version of the Spielberger’s Trait Anxiety Inventory (STAI), r (198) = .73, p < .001. The VAR displayed moderate correlation with trait Negative Affect and Neuroticism. In terms of discriminant validity, the VAR was not related with personality factors including trait Positive Affect, Extraversion, Agreeableness and Openness/Intellect, (n=198, r < .15). Sensitivity of VAR was determined by conducting a repeated measures analysis of variance. Anxiety scores after the procedure (M= 1.05, SD=1.90) were significantly lower than the scores before the procedure (M= 3.69, SD=2.77), F (1, 188) = 151.93, p < .001. The average test-retest correlation between the first four adjacent 15-minute anxiety ratings during the interventional procedure was .66, suggesting moderate to high stability and one hour test-retest reliability was r (130) = .55, p < .001) suggesting moderate stability of VAR (Benotsch et al., 2000).

**Participant Acceptability**

After the scan, participants in the foot massage, touch and presence groups were asked to rate the effectiveness of their experienced condition (foot massage, touch or presence) on a scale of 1-10, with 1 being not effective and 10 being the best. They were also asked whether the length of the intervention was too short, too long or just right and if they would recommend the intervention they were provided, be part of routine MRI care.

**MRI Technologist Participants**

The MRI technologist provided data regarding the number of breaks requested by each participant during MRI and length of time to complete the MRI. Additionally the MRI technologist was asked if use of the body-based intervention during MRI caused any
interruptions in the workflow. If yes, what were those interruptions and did they perceive that adding this intervention increased or decreased the length of an MRI scan.

**Procedures**

Approval to conduct this study was obtained by the Institutional Review Board (IRB) of The University of Arizona before starting this study (Appendix A). Informed consent (Appendix B) was received from each participant after screening and before study procedure began.

**Recruitment and Informed Consent**

Recruitment of the sample was done from the Center for Neurosciences (See Appendix C for site approval letter) by the MRI schedulers who were provided a recruitment script (Appendix D). This script included the purpose of the study along with the phone number of the researcher. The schedulers read this script to the individuals the day before their MRI. Also, the schedulers informed the individuals about this study at the time of them checking in for the MRI examination. All individuals regardless of race, gender or ethnicity were invited to participate in the study. Once a participant met the eligibility criteria (Appendix E) and was consented, the participant completed a brief demographics survey (Appendix F) and baseline anxiety was measured (Appendix G). Individuals were informed of their group assignment before completing the baseline anxiety assessment.

**Group Assignment**

Sample size for this study was 60. A total of 60 packets, one for each participant, 20 packets for each group, were created. It was intended that group assignment would be done by throwing a dice, 2 or less indicated the foot massage intervention group, 3 or 4 indicated the touch intervention group 5 or 6 indicated the presence of the researcher control group. While this was proposed and carried out, being a novice researcher, a second method of group assignment
was adopted. After participants were screened for eligibility, they were presented with three packets and asked to select one (one for each group). The order of the packets varied for each participant. When a group reached 20 participants, further selection was from the remaining group(s) until there were 20 participants in each group. Once a packet was selected, the participant was told his/her group assignment following which a brief demographic survey and baseline anxiety assessment was completed. Participants were aware of their group assignment before their baseline anxiety was measured.

**Positioning in the MRI Scanner**

MRI technologists positioned participants on the MRI table in the MRI room. Every participant was given an option to be covered with a blanket during the MRI. The researcher was present in the MRI suite while participants were positioned. The MRI technologist left the room after positioning participants in the MRI scanner. The researcher stayed with all participants until the MRI was completed. There was a glass window through which the technologist was able to see the patient during MRI. The researcher placed her cell phone clock in the window so that she could keep track of the length of the intervention and collect data at different time intervals.

**Data Collection**

**Patient Data Collection**

Data were collected (1) before the participant was taken to MRI (demographics and anxiety), (2) right after the participant was positioned in the scanner (VAR), (3) at approximately 10 minutes (Mean 10.77, SD = 1.0) into the scan (VAR), (4) at approximately 20 minutes (Mean = 20.55, SD =1.4) into the scan (VAR), (5) at approximately 30 minutes (Mean = 31.83, SD = 3.2) into the scan (VAR), and (6) at the end of the MRI scan (VAR, effectiveness, and length).
It was difficult to measure anxiety at exact 10-minute intervals for all the participants as
the length of the MRI sequence varied from participant to participant and scan to scan. During
the sequence, it was too loud for the participant to hear the question regarding their anxiety level
and there was a potential risk of slight movement. After the scan, participants in the foot
massage, touch and presence groups were asked to rate the effectiveness of their experienced
condition (foot massage, touch or presence) on a scale of 1-10, with 1 being not effective and 10
being the best. They were also asked whether the length of the intervention was too short, too
long or just right and if they would recommend the intervention they were provided be part of
routine MRI care (Appendix H).

MRI Technologist Data Collection

The MRI technologists provided data regarding the number of breaks requested by each
participant during MRI and length of time to complete the MRI. Additionally the MRI
technologist was asked if use of the integrative approach to interventions during MRI caused any
interruptions in the workflow. If yes, what were those interruptions and did they perceive that
adding this intervention increased or decreased the length of an MRI scan (Appendix I).

Intervention

Foot Massage

The researcher, who had received previous training in foot massage techniques, provided
foot massage to individuals assigned to this group, who were all in supine position. For all foot
massage sessions and all MRI scans, the door was kept closed to ensure privacy. Hands were
washed before applying massage. The researcher rubbed her hands so that the hands were warm
to touch when applying massage. The researcher used gloves for unhygienic (visibly dirty) feet
or feet with cracked skin. A hypoallergenic massage lotion was used for massage. Lotion was
applied using brief and gentle strokes to allow lotion to distribute evenly. Foot massage started with gently compressing the calves to promote circulation (Figure 3). With some lubricant on her hands and using hands, palm facing down, lotion was rubbed all over the foot including heel, ankle, and up the calf (Figures 4 and 5).
FIGURE 3. Compressing Calves to Promote Circulation (approved for use by A. Muzzy, 2015).

FIGURE 4. Working the Top of the Foot (approved for use by A. Muzzy, 2015).
Cupping the heel (Figure 6) involved massaging the heel with the thumb or whole palm. Next, the foot was stroked using the thumbs from toes to ankle, while the fingers supported the sole of the foot, this step is called windshield wiper the top of foot (Figure 7). This was followed by troughing (Figure 8), which meant sliding the thumb about two inches down the trough between each of the toes on the top of the foot. The toes were gently pulled as they were rubbed (Figure 9).
FIGURE 6. Cupping the Heel (approved for use by A. Muzzy, 2015).

FIGURE 7. Windshield Wiper the Top of Foot (approved for use by A. Muzzy, 2015).
**FIGURE 8.** Troughing (approved for use by A. Muzzy, 2015).

**FIGURE 9.** Pull Toes (approved for use by A. Muzzy, 2015).
Achilles’ tendon stretch (Figure 10) was performed by holding the heel of one foot in the palm of one hand and the other hand pushed the ball of the foot gently forward stretching the bottom of the foot and the Achilles tendon. Next step was called sandwiching (Figure 11) and it involved interlacing fingers together and wrapping them around the foot gliding from the heel to the toes. Troughing was performed as thumbs glid up as shown in Figure 8. This step was followed by spinal twist (Figure 12), which included holding the foot stationary with one hand, and gentle twistings with the other hand. The whole foot was twisted from top to bottom. Fist gliding (Figure 13) involved massaging the sole of foot by holding the top of participant’s foot with one hand and gliding the other fist down the foot from top to bottom. Left foot was held with right hand and glid with left. Right foot was held with left hand and glid with the right hand (Figure 14). Cross thumb glides (Figure 15) step involved holding the foot with both hands, crossing the thumbs across the bottom of the foot moving up and down the foot, using a cross hatch pattern. This step was followed by thumb walking (Figure 16) five lines from heel of the foot to the ball of the foot. Deep troughing (Figure 17) in the middle of the foot was provided using both hands while standing with face away from the patient. The last step involved wringing the foot (Figure 18) and gentle breeze stroke (Figure 19) in which fingers were brushed lightly along the bottom of the foot to finish.
FIGURE 10. Achilles Tendon Stretch (approved for use by A. Muzzy, 2015).

FIGURE 11. Sandwiching (approved for use by A. Muzzy, 2015).
FIGURE 12. Spinal Twist (approved for use by A. Muzzy, 2015).

FIGURE 13. Fist Glides (approved for use by A. Muzzy, 2015).
FIGURE 14. Fist Glides with a Twist (approved for use by A. Muzzy, 2015).

FIGURE 15. Cross Thumb Glides (approved for use by A. Muzzy, 2015).
FIGURE 16. Thumb Walking (approved for use by A. Muzzy, 2015).

FIGURE 17. Deep Troughing (approved for use by A. Muzzy, 2015).
**FIGURE 18.** Wringing the Foot (approved for use by A. Muzzy, 2015).

**FIGURE 19.** Gentle Breeze Stroke (approved for use by A. Muzzy, 2015).
Above discussed steps were used for foot massage on both feet. After providing foot massage for 20 minutes (10 minutes on each foot), the researcher remained present with the participant until the scan was over. The foot was covered after completing massage on one foot (C. Avendar, 2013). Similar steps of massage were followed on both feet (A. Muzzy, personal communication, February, 2015).

**Touch Intervention**

The researcher washed her hands before touching participant’s feet/lower legs. The researcher gently stroked for 20 minutes (10 minutes each leg) the participant’s lower legs. The researcher gently stroked the lower legs over the blanket for the participants whose legs were covered during the MRI scan. At the end of the 20 minutes, the researcher remained present with the participant until the scan was over.

**Presence Group**

The researcher was present throughout the MRI scan with the participants in the presence group. Participants had an option to see the researcher through a mirror that was placed on the participant’s head.

**Training and Monitoring Plan**

Training is required for proper implementation of foot massage. One does not need to be a licensed massage therapist to massage the hands, feet or head (Arizona Board of Massage, §324201 & §324252), but one does need to have knowledge of different massaging strokes, how to use these strokes, and the likely candidates for massage (Meintz, 1995). Training by an experienced licensed massage therapist helps acquire cognitive and dexterity skills required to perform foot massage in a specific sequence and for a prescribed amount of time. Initial training
for two hours covered use of Swedish massage techniques - effleurage (gentle stroke movements), petrissage (squeezing of deep tissue and muscles), kneading (gentle compression of soft tissue underlying against the bone), friction (penetrating pressure applied through the finger tips) and tapotement (percussive massage such as cupping of hands technique that vibrates tissue) (Goats, 1994). The routine was intended to take about 10 minutes of massage per foot to perform. The trainer went over each technique on a demo individual, and then interventionist in training performed a return demonstration to perfect the technique (see Appendix J for foot massage certificate).

The validity of the consistent application of the foot massage intervention was evaluated by monitoring its fidelity. It is important to document the strokes/techniques used for foot massage along with the length of massage for maintaining internal and external validity and for translation of research into practice (Sidani & Braden, 2011). Since it was hard to memorize all the steps of foot massage, the researcher, who applied the intervention for all subjects, followed a reference sheet that had all the steps of foot massage (Table 1). The length of the intervention (20 minutes foot massage and touch) was decided based on the information received that the MRI scans last 30 minutes or more. However, during this study, some MRI scans for individuals in the touch and foot massage groups lasted less than 20 minutes. For these scans, the researcher provided foot massage or touch to the first foot/lower leg for 10 minutes and the second foot/lower leg for the remainder of the scan (see Appendix K).
TABLE 1. *Reference Sheet.*

<table>
<thead>
<tr>
<th><strong>10 Minute Foot Massage Steps</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pre-massage Compressions</td>
</tr>
</tbody>
</table>

**Working the Top of the Foot**
1. Palming the Foot Thoroughly
2. Palming Up the Leg
3. Cupping the Heel
4. Windshield Wiper the Top of the Foot
5. Troughing
6. Pull Toes
7. Achilles Tendon Stretch
8. Sandwiching
9. Spinal Twist

**Sole of the Foot**
1. Fist Glides
2. Fist Glides with a Twist
3. Cross Thumb Glides
4. Thumb Walking Across Sole of the Foot
5. Deep Troughing

**Saying Goodbye**
1. Wringing
2. Breeze Strokes

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**Data Analysis**

The statistical package SPSS version 22 (SPSS, 2013) was used for data analysis. During data collection, data files were set up, followed by checking for any errors in the data. Descriptive statistics were used to describe the sample. Several types of analyses were used, including: frequency counts, descriptive statistics (e.g., mean, standard deviation, median), and normality (e.g., skewness, kurtosis, frequency histograms) for continuous variables. Chi square test was used to evaluate any differences among groups on categorical variables and one-way
analysis of variance (ANOVA) was used for continuous variables. Chi square test was used to determine group differences in acceptability to the length of the treatment and recommendation of the relevant condition (touch, foot massage, presence). One-way ANOVA was used to evaluate the effectiveness of treatment conditions. One-way ANOVA was used to evaluate baseline group differences for all continuous demographics and anxiety variables. If there were differences among the groups on any of these variables, that variable was used as a covariate. Use of the baseline measure as a covariate is an accepted statistical procedure. “There is no statistical requirement for the treatment variable and covariate to be independent” (Field, 2013, p. 486). Because there were differences between the groups on baseline anxiety, it was used as a covariate in repeated measures analysis of variance (repeated measures ANCOVA).

Repeated measure analysis revealed that the intercept was different for all three groups. ANOVA assumes equal spacing between time intervals (Kwok, Underhill, Berry, Luo, Elliott & Yoon, 2008). However, the time spacing was not equal in these data. Also, the data were hierarchically clustered meaning that certain “variables are clustered within other variables” (Field, 2009, p.726). Repeated measurements (time) were nested in participants and participants were nested in intervention groups (foot massage, touch and presence). Based on these findings, there was a need for a different statistical modeling. For data that are nested, in this case repeated measurements of anxiety within persons and persons nested in intervention group, multilevel modeling is the appropriate data analytic technique (Kwok et al., 2008).

**Multilevel Modeling**

Multilevel modeling (MLM) takes sampling hierarchy into account (Hox, 1998). This study had a three-stage clustered sample; repeated measurements (time) nested in participants
nested in intervention groups (foot massage, touch and presence). The power for this study was calculated using repeated measures ANOVA as a statistical test. As a general rule, Kreft (1996) recommends 30 units per cluster for the required sample size for multilevel models. Given the concerns for power, a two level model was used, using the interventions (foot massage, touch) as predictors and presence as a comparison group. A mixed model procedure was used in SPSS 22.0. The steps (1-6) taken to find a model that would fit the best are listed in Table 2. Step 7 assessed the error structure of the data.

TABLE 2. Steps of MLM Analysis.

<table>
<thead>
<tr>
<th>Steps of MLM Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Run Model 1 to examine any mean differences in anxiety at baseline.</td>
</tr>
<tr>
<td>3. Run Model 2 to examine the effect of time on rate of change in anxiety over time.</td>
</tr>
<tr>
<td>4. Run Model 3 &amp; 4 by including predictors foot massage and touch; and presence as a comparison group</td>
</tr>
<tr>
<td>5. Run Model 5 &amp; 6 by including quadratic (Time²) and cubic (Time³) polynomials to examine the effect of polynomial time trends on anxiety.</td>
</tr>
<tr>
<td>6. Run Model 7 by including foot massage and touch predictors to polynomials.</td>
</tr>
<tr>
<td>7. Assess the best error structure of the data.</td>
</tr>
<tr>
<td>8. Select the best model.</td>
</tr>
</tbody>
</table>

According to Kwok et al. (2008), the first step to data analysis using MLM is to transform the multivariate data (each row in data editor represents a person) into univariate data (each row represents a time point rather than a person). In this analysis, the multivariate dataset was converted to a univariate dataset in SPSS. Examining a random intercept-only model is the first step in any growth model to establish exactly how the repeated measures change with time.
(Kwok et al., 2008). It was examined whether an intercept-only model (model 1) would fit to examine any mean differences in anxiety across individuals at baseline. “This intercept-only model can then be expanded in a variety of directions. The most straightforward method is to consider the family of polynomial functions; examples include a straight line, a quadratic curve, and a cubic curve” (Curran, Obeidat, & Losardo, 2010). Model 2 would examine whether the rate of change in anxiety is linear. Model 3 would determine whether foot massage and touch predictors were related to linear growth curve. Model 4 would examine whether the predictor foot massage and the comparison group “presence” were related to linear growth curve. Model 5 and model 6 would determine whether two higher-order polynomial models – square root and cubic affect the rate of change in anxiety across time. Conditional growth model (model 7) as described by Curran, Obeidat, & Losardo (2010) includes predictors in the model. The inclusion of foot massage and touch predictors in the conditional growth model (model 7) in addition to time and higher-order polynomials, square root and cubic, would determine whether foot massage and touch predictors had an effect on anxiety across time during MRI. Three different covariance structure models (models 8,9 and 10) were compared in order to assess the error covariance structure of the longitudinal data (see Table 10). The best model was selected based on the value of Akaike Information Criterion (AIC), which is “a goodness-of-fit measure” (Field, 2009, p.737). Generally, the smaller the AIC values, the better the model fit (Posada & Krandall, 1998).
Human Protection Plan

Confidentiality

Records of demographic variables, informed consent, and questionnaires were kept in a locked cabinet in the researcher’s home during the research process/study. At the conclusion of the study, signed consent forms and questionnaires were stored at College of Nursing per University of Arizona policy.

Risk to Participants

Risks to participating in the study included sensitivity to the hypoallergenic lotion. If the participant was unable to tolerate the foot massage due to overly sensitive feet, the foot massage was terminated and the participant withdrawn from the study. None of the participants in the foot massage group experienced any difficulty with the foot massage or the lotion used. One participant experienced anxiety when placed in the scanner and the MRI was terminated. This participant was withdrawn from the study.

Summary

This study tested the feasibility of integrative approach to interventions and their effect on anxiety during MRI. Using a quasi-experimental design, eligible participants were recruited from the CNS and assigned to one of the three conditions: foot massage, touch or presence. The intervention protocols were applied. VAR was used as the main data collection tool to measure anxiety across time. The psychometric properties of VAR were discussed. Data were collected from the participants and MRI technologists in order to determine the acceptability of the physical presence, human touch or foot massage interventions. Human protection plan in terms of confidentiality of the data and risk to participants was discussed. Statistical models, repeated
measures ANCOVA and MLM, were used for data analysis to determine the effect of interventions on anxiety during the MRI.
CHAPTER 4: FINDINGS

The purpose of this feasibility study was to: (1) determine recruitment rates; (2) determine adherence to a touch or foot massage intervention; (3) determine provider and participant’s acceptability of physical presence, human touch or foot massage intervention; and (4) examine the preliminary effects of touch or foot massage intervention as compared to physical presence during MRI on anxiety. This chapter discusses the findings of the study. It presents the characteristics of the sample and the findings of the recruitment rate in addition to the researcher’s adherence to foot massage and touch interventions. Participants’ acceptability of the intervention is examined in terms of their acceptability of the length of the treatment as well as their evaluation of the effectiveness of the intervention and their recommendation of the treatment. The MRI technologists’ acceptability of the intervention is also assessed. The chapter concludes with an evaluation of the effect of integrative approaches to interventions on anxiety levels during MRI using ANCOVA and MLM statistical tests.

Characteristics of Sample

Sixty-one patients were recruited and enrolled in the study. One patient was claustrophobic. She declined to complete the scan right after she was placed on the MRI table. The characteristics of the remaining 60 patients who enrolled and completed the scan and the study are listed in Table 3. These 60 patients were assigned to one of three groups - foot massage, touch or presence. Table 3 compares the participants in three groups with respect to all the relevant characteristic variables.

In this sample, there were 39 female (65%) and 21 male (35%) participants. However, the difference in gender among groups was not significant ($\chi^2 = 5.714 \ (2), \ p = .057$). The study
participants were predominantly Caucasians (58.3%), married (55%) and college-level educated (43.3%). Annual family income level for 30% of study participants was less than $15,999 and 30% of the participants had a yearly family income of more than $75,000. The difference among groups in relation to marital status $\chi^2=3.621(8)$, ($p = .89$), ethnicity $\chi^2=8.980(8)$, ($p = .344$), annual family income $\chi^2=15.179(8)$, ($p = .056$), and education $\chi^2=6.143(8)$, ($p = .631$) was not significant. There were no differences among groups on demographic characteristics.

Patients who had taken analgesics and or anti-anxiety medications prior to MRI examination were not included. There was one participant who had taken one Tylenol eight hours prior to MRI examination who was included and completed the study and MRI examination. The study participants had MRI of various body regions such as head, neck, head and neck, thoracic and lumbar body regions. Although, the majority of the participants (53.3%) had MRI head examination, the difference among groups in relation to body region being scanned was not significant $\chi^2=7.050(8)$, ($p = .531$).

Age, length of the MRI scan and baseline anxiety characteristics of the sixty patients who enrolled and completed the scan and the study are listed in Table 3. The mean age of the sample was 51.07 years, SD = 15. The mean age of the sample in foot massage (53.15 years, SD=16.8) and touch groups (53.80, SD=16.2) was older than the mean age of presence group members (46.25 years, SD=10.9). However, the difference among groups in relation to age was not significant ($F=1.584(2, 57)$, $p = .214$). The mean length of the MRI scan was 31.58 minutes, SD=9.9. The difference among foot massage (32.49 minutes, SD=9.8), touch (31.69 minutes, SD=12.5) and presence groups (30.65 minutes, SD=7) in relation to the length of the scan was not significant, ($F= .153(2, 57)$, $p = .858$). The mean anxiety score before MRI for the entire
sample was 3.67, SD=2.8. The difference in mean anxiety score before MRI among foot massage (2.60, SD=2.7), touch (4.85, SD=2.4) and presence (3.55, SD=2.9) groups was significant (F=3.511(2, 57), p = .036) (Table 4). Post hoc analysis (Bonferonni) showed that the baseline anxiety difference in the touch group was significantly higher than the foot massage group.

There were no significant differences between the other groups.

TABLE 3. Characteristics of the Study Participants.

<table>
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<th>Characteristics</th>
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<th>Touch</th>
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<td>%</td>
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<td>Body Region Being Scanned</td>
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</table>
Aim One: Recruitment Feasibility

The first aim of this study was to determine the recruitment rate. The research question being answered for this aim was: Is it feasible to recruit participants for human touch and foot massage intervention during MRI? Seventy-eight patients scheduled for MRI of the head and or spine were recruited at the CNS and screened for eligibility as shown in Figure 21. Of the 78 patients, 17 did not qualify to participate. The main reasons for ineligibility were patients (n=8) taking antianxiety medication, first time MRI scan (n=3), dementia (n=3), pain-killers (n=2), and Spanish speaking (n=1). Among the remaining 61 patients, one patient was claustrophobic and did not complete the scan. The scan was aborted right after she was placed on the table for the scan. The remaining 60 patients who were enrolled in the study received one of the three study conditions: foot massage, touch or presence during MRI and completed the MRI scan. Since 60 participants were enrolled out of 78 screened participants, recruitment rate of this study is 78.2%. It was feasible to recruit participants for this study.
Aim Two: Feasibility of Foot Massage and Touch Interventions

The second aim of this study was to determine whether it was feasible to apply a touch or foot massage intervention per protocol during MRI. The research question being answered for this aim was: Is it feasible to apply a touch or foot massage intervention per protocol during MRI? There were two factors that determined adherence to the foot massage intervention: (1) participants in the foot massage group received massage for 10 minutes on each foot and (2) the researcher followed all the steps of the foot-massage protocol as described in Chapter 3, Table 1.

Foot Massage Group

There were a total of 20 participants in the foot massage group. The length of the MRI scan in this group ranged from 15-55 minutes. The mean length of the MRI scans was 32.4 minutes, SD = 9.8. Eighteen participants received foot massage for 20 minutes, 10 minutes on each foot. There were two participants in the foot massage group whose scan lasted 15 and 18
minutes. Because the scan lasted less than 20 minutes, the researcher was able to massage the second foot for only five and eight minutes respectively for these two participants. Therefore, of the 20 participants receiving foot massage, two did not receive the full intervention.

The researcher used the reference sheet that had all the steps of foot massage while providing the intervention (Table 1). The reference sheet helped the researcher adhere to the foot massage protocol on every patient except for the two for whom the scans lasted less than 20 minutes. The routine is intended to take about 10 minutes of massage per foot to perform.

**Touch Group**

There were 20 participants in the touch intervention group. The researcher was able to apply gentle touch to the lower legs of these participants. The length of the scans in this group ranged from 15.15-58 minutes. The mean length of the scans was 31.68 minutes, SD = 12.5. Seventeen participants received touch for 20 minutes. There were three participants whose scans lasted for 15.2, 15.5 and 18 minutes. For these participants, the researcher was not able to provide the touch intervention for the full 20 minutes because their scan length was less than 20 minutes. As with the application of foot massage, the touch intervention was disrupted by scan lengths of shorter duration times.

**Aim Three: Participant and Provider’s Acceptability of the Interventions**

The third aim of this feasibility study was to determine whether physical presence, human touch and foot massage were acceptable to provider and participants during MRI. The research question being answered for this aim was: Is physical presence, human touch and foot massage acceptable to provider and participants during MRI?
Participant Acceptance

There were four factors that determined participants’ acceptance of the interventions during MRI: (a) participants’ comfort during treatment; (b) participants’ acceptability of the length of the treatment (Table 5); (c) participants’ evaluation of effectiveness of the intervention (Table 6); and (d) participants’ recommendation of treatment as part of routine MRI care (Table 7). All the study participants (N = 60) were comfortable during the interventions, whether foot massage, presence or touch.

Participants’ Acceptability of the Length of the Treatment

Although the foot massage and touch interventions were applied for 20 minutes, the researcher remained present with the participant until the scan was completed. In the presence group, the researcher was present throughout the length of the scan. The length of the intervention was “just right” for the majority of the study participants (75%).

TABLE 5. Participants’ Acceptability of the Length of the Treatment.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total</th>
<th>N</th>
<th>%</th>
<th>Foot massage</th>
<th>N</th>
<th>%</th>
<th>Touch</th>
<th>N</th>
<th>%</th>
<th>Presence</th>
<th>N</th>
<th>%</th>
<th>Chi-square</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment Length</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Too Long</td>
<td>1</td>
<td>1</td>
<td>1.7</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td>1</td>
<td>5</td>
<td>9.467</td>
<td>.149</td>
</tr>
<tr>
<td>Too Short</td>
<td>9</td>
<td>15</td>
<td>15</td>
<td>4</td>
<td>20</td>
<td>20</td>
<td></td>
<td>5</td>
<td>25</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Just Right</td>
<td>45</td>
<td>75</td>
<td>75</td>
<td>15</td>
<td>75</td>
<td>75</td>
<td></td>
<td>11</td>
<td>55</td>
<td>19</td>
<td>25</td>
<td>95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preferred throughout</td>
<td>5</td>
<td>8.3</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>20</td>
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<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Some participants in the foot massage group (n = 4, 20%) and touch group (n = 5, 25%) felt that the length of the treatment was “too short” and others (n = 5, 8.3%) in the foot massage and touch groups preferred the intervention be provided for the duration of the scan. Only one participant in the presence group felt that the researcher was present for “too long” during the MRI (Table 5).
Participants’ Evaluation of Effectiveness of the Intervention

Participants in foot massage, touch and presence groups were asked to rate the effectiveness of received intervention on a scale of 1-10, with 1 being not effective and 10 being the most effective. The overall mean value of effectiveness was 8.53, SD = 2.4 (see Table 6). There was a significant difference among the three groups in terms of effectiveness of the intervention F=15.19(2, 57), p < .001. Post hoc analysis (Bonferroni) showed that participants rated touch (M=9.1, p=.001) and foot massage (M=9.9, p=.001) interventions as significantly more effective than the presence intervention. Nevertheless, even with the researcher’s presence, participants reported a mean effectiveness of 6.6, SD = 3.2.


<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total Mean</th>
<th>SD</th>
<th>Foot Massage Mean</th>
<th>SD</th>
<th>Touch Mean</th>
<th>SD</th>
<th>Presence Mean</th>
<th>SD</th>
<th>One-Way Anova (df)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effectiveness</td>
<td>8.53</td>
<td>2.4</td>
<td>9.9</td>
<td>.3</td>
<td>9.10</td>
<td>1.1</td>
<td>6.6</td>
<td>3.2</td>
<td>15.19(2,57)</td>
<td>.001</td>
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</tbody>
</table>

Participants’ Recommendation of Treatment

Participants were also asked whether they would recommend foot massage, touch or presence interventions to be part of routine MRI care. Although the majority of the study participants (81.7%) recommended these interventions (foot massage, presence, touch) be part of routine MRI care, about 11.7% recommended that the use of these interventions should be according to patient preference. Two participants (10%) in the presence group mentioned that the presence of the researcher did not make any difference (Table 7).
Another 10% of the participants in the presence group recommended that the “presence” intervention be provided by a loved one. Overall, there was no significant difference among the groups in relation to participants’ recommendation of the interventions ($\chi^2 = 9.467, p=.149$) (Table 7).

**MRI Technologists’ Acceptability**

The MRI technologists’ acceptability was determined by two factors: (1) whether the intervention disrupted the workflow and (2) whether the intervention increased or decreased the length of the scan. Initially, for the first couple of scans, the technologists felt that they had to keep track of time on when to ask the question on anxiety assessment and it was slowing the MRI scan by 1 or 1.5 minutes. But as the researcher determined a way to make it easier for the technologist by keeping track of time and asking the anxiety question herself, the technologist was relieved of that responsibility. As a result, the interpersonal relationship between the researcher and the technologists was cultivated, and these relationships continued to flourish throughout the remainder of the study. Overall, the technologist felt that these interventions were helpful to the participants in keeping them calm and they did not disrupt the workflow or increase or decrease the length of the scan.

### TABLE 7: Participants’ Recommendation of Treatment.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Total N</th>
<th>%</th>
<th>Foot massage N</th>
<th>%</th>
<th>Touch N</th>
<th>%</th>
<th>Presence N</th>
<th>%</th>
<th>Chi-square</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommendation</td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>Yes</td>
<td>49</td>
<td>81.7</td>
<td>19</td>
<td>95</td>
<td>18</td>
<td>90</td>
<td>12</td>
<td>60</td>
<td>9.467</td>
</tr>
<tr>
<td>No</td>
<td>2</td>
<td>3.3</td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
<td>2</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Patient Preference</td>
<td>7</td>
<td>11.7</td>
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<td>2</td>
<td>10</td>
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<td>20</td>
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<tr>
<td>For loved one</td>
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<td>3.3</td>
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<td></td>
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<td></td>
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</tr>
</tbody>
</table>
Aim Four: Effect of Body-based Interventions on Anxiety Levels During MRI

The fourth aim of this study was to examine whether there was a difference in the levels of anxiety among patients receiving human touch or foot massage as compared to physical presence during MRI. The research question being answered for this aim was, Is there a difference in the levels of anxiety among patients receiving human touch or foot massage as compared to physical presence during MRI? Repeated measures ANCOVA analysis was conducted to answer this research question.

Repeated Measure Analysis

As described in Chapter 3, only 45 participants were needed for this study based on the power analysis for an ANOVA model. A total of 60 participants were recruited in order to avoid a problem with insufficient sample because of participants unable to complete the scan. Out of 60, 55 participants (Foot massage, n=18; Touch, n= 17; Presence, n= 20) who received the intervention for at least 20 minutes, were included in this analysis. The remaining five participants whose scan lasted for less than 20 minutes were not included in this analysis.

In this study, anxiety levels were measured six times: (1) before the patient was taken to MRI, (2) right after patient was positioned in the scanner, (3) at approximately 10 minutes (Mean 10.77, SD= 1.0) into the scan, (4) at approximately 20 minutes (Mean =20.55, SD=1.4) into the scan, (5) at approximately 30 minutes (Mean = 31.83, SD=3.2) into the scan and (6) at the end of the MRI scan. It was difficult to measure anxiety scores at exact 10 minute intervals for all the participants as the length of the sequence varied from participant to participant and scan to scan. During the sequence, it was too loud for the participant to hear the question regarding their anxiety level and there was a potential risk of slight movement.
As described previously, the mean anxiety score for the sample at baseline was 3.67, SD=2.8. The difference in baseline anxiety score among foot massage (2.60, SD=2.7), touch (4.85, SD=2.4) and presence (3.55, SD=2.9) groups was significant, (F=3.51(2, 57), p=.036) with the touch group significantly higher than the foot massage group. Since there was a significant difference in baseline anxiety among groups, the ANCOVA was fit using baseline anxiety as a covariate to remove the effect of baseline anxiety scores and fairly compare post baseline anxiety scores among the groups. Use of the baseline measure as a covariate is an accepted statistical procedure. “There is no statistical requirement for the treatment variable and covariate to be independent” (Field, 2013, p. 486).

Analysis revealed that there was no significant group F=.092(2.3, 119.6), p = .964; time F=2.088(2, 51), p=.134 or group by time difference F = .092(2.3, 119.6), p=.964 in anxiety (Table 8 and Table 9). For all three groups, there was a non-significant decrease in anxiety across time with the decrease in anxiety greater for foot massage and touch groups than for presence. There was a slight increase in anxiety right after 20 minutes when foot massage ended. However, the anxiety score of the foot massage group at the end of the MRI scan remained lower than that of the other groups (Figure 22.). This analysis revealed that there was no significant difference in the levels of anxiety among patients receiving human touch or foot massage as compared to the physical presence during MRI.

<table>
<thead>
<tr>
<th></th>
<th>Sum of Squares SS</th>
<th>Mean Square</th>
<th>F-Value</th>
<th>df</th>
<th>P</th>
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<tbody>
<tr>
<td>Group</td>
<td>8.967</td>
<td>4.484</td>
<td>2.088</td>
<td>2</td>
<td>.134</td>
</tr>
<tr>
<td>Time</td>
<td>.520</td>
<td>.222</td>
<td>.092</td>
<td>2.345</td>
<td>.936</td>
</tr>
<tr>
<td>Group x Time</td>
<td>14.106</td>
<td>3.007</td>
<td>1.245</td>
<td>4.691</td>
<td>.293</td>
</tr>
<tr>
<td>Baseline anxiety x Time (covariate)</td>
<td>58.669</td>
<td>25.015</td>
<td>10.358</td>
<td>2.345</td>
<td>.000</td>
</tr>
</tbody>
</table>
TABLE 9. *Mean Anxiety Scores Adjusted by Baseline Anxiety Score.*

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Anxiety right after positioning Mean</th>
<th>SE</th>
<th>Anxiety at minimum 10 minutes Mean</th>
<th>SE</th>
<th>Anxiety at minimum 20 minutes Mean</th>
<th>SE</th>
<th>Anxiety at the end of MRI Mean</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foot massage</td>
<td>18</td>
<td>3.74</td>
<td>0.36</td>
<td>2.21</td>
<td>0.45</td>
<td>1.20</td>
<td>0.47</td>
<td>1.41</td>
<td>0.56</td>
</tr>
<tr>
<td>Touch</td>
<td>17</td>
<td>4.37</td>
<td>0.35</td>
<td>3.15</td>
<td>0.44</td>
<td>2.84</td>
<td>0.46</td>
<td>1.89</td>
<td>0.55</td>
</tr>
<tr>
<td>Presence</td>
<td>20</td>
<td>3.81</td>
<td>0.32</td>
<td>3.22</td>
<td>0.41</td>
<td>2.79</td>
<td>0.43</td>
<td>2.23</td>
<td>0.51</td>
</tr>
</tbody>
</table>

Need for Further Analysis

In this study, the data were hierarchically clustered and the time spacing was not equal. Also, the data analysis revealed that the intercept was different for all three groups. Based on these findings, there was a need for a different statistical analysis. For repeated measures data, multilevel modelling can be an alternative analysis (Kwok et al., 2008).

Multilevel Modeling

A two level model was fit using the interventions (foot massage, touch) as predictors and presence as a comparison group. The multivariate dataset was transformed to a univariate dataset in SPSS (Kwok et al., 2008). A random intercept-only model (model 1) examined any mean differences in anxiety across individuals at baseline. As discussed in Chapter 3, “This intercept-only model can then be expanded in a variety of directions. The most straightforward method is to consider the family of polynomial functions; examples include a straight line, a quadratic curve, and a cubic curve” (Curran, Obeidat & Losardo, 2010, p 127). Model 2 examined whether change in anxiety is a straight line (time). Model 3 examined whether the predictors foot massage and touch were related to a linear growth curve (time), and model 4 examined whether the predictor foot massage and the comparison group “presence” were related to a linear growth curve (time). Models 5 and 6 determined whether two higher-order polynomial models square root (time² and time³) affect the rate of change in anxiety across time. The inclusion of foot massage and touch predictors in the conditional growth model (model 7) in addition to time and higher-order polynomials, square root and cubic, examined whether foot massage and touch interventions had an effect on anxiety across time during MRI. The error covariance structure of the longitudinal data was assessed by comparing three different covariance structure models
(models 8, 9 and 10). The best model was selected based on the value of Akaike Information Criterion (AIC), which is “a goodness-of-fit measure” (Field, 2009, p.737). Generally, the smaller the AIC values, the better the model fit (Posada & Krandall, 1998). The results of these models are discussed below.

**Model 1 - An intercept-only model.** This model examined any mean differences in anxiety across individuals. It assessed the mean of the outcome variable and the amount of variation that existed in intra- and inter-individual levels. Mean of the outcome anxiety variable was found to be 2.91. The intraclass correlation (ICC) was .58 which means that 58% of total variation in anxiety was due to inter-individual differences. “The ICC represents the proportion of the total variability in the outcome that is attributable to [individuals]” (Field, 2009, p.729).

**Model 2 - Linear growth curve model.** This model explored whether the growth curve (change in anxiety across time) was linear or curvilinear. The values of both intercept and linear slope parameters were significant indicating that the baseline and linear growth rate varied over time. The mean estimated baseline anxiety was 4.31, (SE= 0.41, p < 0.001) and the linear growth rate for the sample was -.43. There was a significant linear decrease in anxiety (β = -0.43, SE= 0.076, p< 0.001). There was a decline in the residual variance of 1.58, indicating that only 1.6% of the within-individual variation in anxiety was associated with linear rate of change. The sign associated with the β-value reflects positive or negative change (Audrain-McGovern, Rodriguez & Moss, 2003). The negligible correlation (β = -1.119, SE = .309, p < .001) between the intercept and linear growth parameter was negative, meaning there was only a negligible decrease in anxiety over time.

**Model 3 - Conditional (foot massage and touch) linear model.** This model examined whether the predictors foot massage and touch were related to linear growth curve (i.e., intercept,
and linear slope). There was a significant linear decrease in anxiety over time ($\beta = -0.43$, $SE = 0.076$, $p < 0.001$). Foot massage was a significant predictor in the model ($\beta = -1.33$, $SE = 0.63$, $p < 0.01$). Negative sign associated with the $\beta$-value for foot massage group revealed that there was a significant decrease in anxiety. Effect of the touch predictor was not significant ($\beta = .55$, $SE = 0.63$, $p = .390$).

**Model 4 – Conditional (foot massage and presence) linear model.** This model examined whether the predictor foot massage and the comparison group “presence” were related to linear growth curve (i.e., intercept, and linear slope). There was a significant linear decrease in anxiety over time ($\beta = -0.43$, $SE = 0.076$, $p < 0.001$). Foot massage was a significant predictor in the model ($\beta = -1.88$, $SE = 0.63$, $p < 0.01$). The negative sign associated with the $\beta$-value for foot massage revealed that there was a significant decrease in anxiety. Although the negative effect (negative $\beta$-value) of the presence group suggested that there was a decrease in anxiety with presence, this decrease was not significant ($\beta = -.55$, $SE = 0.63$, $p = .390$).

**Models 5 and 6 - Polynomial growth curve model.** Two higher order polynomial models (quadratic and cubic) were used to determine if the quadratic and cubic trends affect the rate of change of anxiety. Quadratic and cubic polynomials had a significant contribution in the model ($p < 0.001$). As mentioned earlier, the sign associated with the $\beta$-value reflects positive or negative change (Audrain-McGovern, Rodriguez & Moss, 2003). The negative effect of quadratic growth ($\beta = -1.48$, $SE = 0.55$, $p < 0.01$) indicated a decrease in the rate of change. However, the positive effect of cubic growth ($\beta = .369$, $SE = 0.14$, $p < 0.01$) suggests that it diminished over time. Crucially, the model with both quadratic and cubic factors (AIC = 1287.045) actually fit the data worse than did the model with only linear time (AIC = 1282.390).
The smaller the value of AIC, the better the model fits (Field, 2009, p. 737). Therefore, the linear model is a better fit than the two higher order polynomial models.

**Model 7 - Conditional polynomial model.** This model examined whether the foot massage and touch interventions were related to growth parameters (i.e., intercept, linear slope, quadratic growth and cubic growth). Quadratic and cubic polynomials had a significant contribution in the model (p< 0.001). The negative effect of quadratic growth ($\beta = -1.48$, SE = 0.55, $p <0.01$) indicated a decrease in the rate of change. However, the positive effect of cubic growth ($\beta = .369$, SE= 0.14, $p < 0.01$) suggests that it diminished over time. In addition, the foot massage intervention was a significant predictor in the model ($\beta= -1.35$, SE=.63, $p < 0.01$). The effect of the touch intervention was not significant ($\beta= .54$, SE=.63, $p =.395$). The negative effect of the foot massage intervention indicated a decrease in rate of change of anxiety. The value of AIC of model 7 was 1282.305. Although this value was little less than the AIC value of the linear model (AIC=1282.390), model 7 actually fit the data worse than the linear model. This is because model 7 had more degrees of freedom (time, time$^2$ and time$^3$, foot massage, touch) than the linear model (time). The sample size for this study was only 60. As a general rule, Kreft (1996) recommends 30 units per cluster for the required sample size for multilevel models. Given the restraint of power in this study (N=60, 20 per cluster) and increased degrees of freedom in model 7, the linear model is a better fit than the conditional model even if AIC value of model 7 is slightly higher than the AIC value of the linear model.

**Models 8, 9 and 10.** Three different covariance structures were run in order to assess the error covariance structure of the longitudinal data and estimate the error for the overall model. These three covariance structures were: (a) unstructured (b) compound symmetry (c) autoregressive (Field, 2009). These structures were compared by looking at the AIC value (see
Table 10). The AIC value for unstructured covariant (AIC=1280.998) structure was smaller than the compound symmetry (AIC=1334.466) and autoregressive structure (AIC=1334.466). Smaller the value of AIC, the better the model fit (Posada & Krandall, 1998). This means that the unstructured covariant structure is the best fit to estimate the error for the overall model.

**Model Selection**

The best model was selected based on the AIC value. Generally, the smaller the statistical values, the better the model fit (Posada & Krandall, 1998). A linear model has been chosen based on the AIC value and number of parameters in the model (Table 10). There was a significant decrease in anxiety based on the negative and significant slope for the foot massage group. There was no significant decrease in anxiety among patients receiving touch or patients in the presence group.
### TABLE 10. Multilevel Modeling

<table>
<thead>
<tr>
<th>Fixed Effect</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
<th>Model 7</th>
<th>Model 8</th>
<th>Model 9</th>
<th>Model 10</th>
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</thead>
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<tr>
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<td>4.574048</td>
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<td>3.729218</td>
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<td>(SE)</td>
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<td>(.076507)</td>
<td>(.076507)</td>
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Conclusion

All the specific aims were addressed during this feasibility study. It was feasible to recruit participants for presence, human touch, and foot massage interventions during MRI. The researcher was able to apply touch or foot massage interventions per protocol during MRI for the study participants with the exception of those whose scan lasted less than 20 minutes. The majority of the study participants recommended that physical presence, human touch and/or foot massage be part of routine MRI care. Based on MLM analysis, there was a significant decrease in anxiety for the foot massage group (models 3, 4 and 7). Neither the touch (model 3s and 7) nor the comparison group “presence” (model 4) exhibited a significant reduction in anxiety.
CHAPTER 5: DISCUSSION

This final chapter will review the findings from the study on feasibility of integrative measures to interventions in reducing anxiety during Magnetic Resonance Imaging. The specific aims were to: (1) determine recruitment rates; (2) determine adherence to a touch or foot massage intervention; (3) determine provider and participant’s acceptability of physical presence, human touch and foot massage interventions; and (4) examine the effects of touch or foot massage interventions as compared to physical presence during MRI on anxiety. Also discussed in this chapter are the limitations and implications for future nursing research involving use of integrative measures to interventions to decrease anxiety during MRI.

Characteristics of the Participants

In this study, anxiety was assessed using a brief verbally administered anxiety rating (VAR). VAR is a 0-10 linear numerical rating scale in which the score of five or greater on VAR suggests anxiety. The self-reported anxiety score of 43.3% of the participants was five or greater. This finding supports the findings in the literature. Other studies have reported that anticipatory anxiety is experienced by about 37% of all patients undergoing this examination (Katz et al., 1994; Quirk, Letendre, Ciottone, & Lingley, 1989a; van Minde, Klaming, & Weda, 2013).

There are studies that have revealed that self-reported anxiety is usually highest with the first MRI scan but decreases with subsequent scans (Chapman, Bernier, & Rusak, 2010). All the participants included in this study had had an MRI before. Although, the participants were not asked to compare their anxiety score with the anxiety level during their previous or first MRI, as stated previously, 43.3% of the participants were still found to be anxious for their subsequent scans.
Also, female participants (46.2%) reported higher pre-scan anxiety as compared to males (38.1%) in this study. This finding is similar to the finding by Katz et al. (1994) who reported that female patients had higher pre-scan anxiety (Katz et al., 1994).

The highest anxiety levels were reported at the beginning of the MRI session. The use of integrative measures helped decrease the anxiety level at the end of the session. Chapman et al. (2010) reported the highest anxiety levels were at the beginning and at the end of the MRI scan. Unlike the study presented here, in Chapman’s study, there was no intervention provided during the MRI scan.

There were 61 participants who were eligible to participate in the study. One out of 61 participants (1.6%) was not able to begin the scan because of claustrophobia and hence this scan had to be aborted, compatible with findings from other studies, which have revealed estimations of terminated sessions due to anxiety ranged from about 2% (Chapman et al., 2010) to 5% (Murphy & Brunberg, 1997).

**Aim One: Recruitment Feasibility**

Recruitment of participants from the Center for Neurosciences generated a recruitment rate of 78.2%. It took a little over two months to recruit the participants (05/02/2015 to 07/07/2015). It was feasible to recruit participants for this study. There were two schedulers who took turns on a weekly basis to inform the patients about this study. The schedulers called the patients the day before their appointment to confirm the appointment and to give information about this study. Most of the time, they ended up leaving messages for the participants about the study and their appointment time. A few times, there were a couple of patients who called the schedulers back to confirm their appointment and to indicate their willingness to participate in the study. In addition to this, the staff at CNS informed the participants about the study on the
day of their appointment. The staff at CNS was very supportive of this study and never hesitated to inform the patients about the study.

**Aim Two: Feasibility of Foot Massage and Touch Interventions**

It was feasible to follow the intervention protocols for both foot massage and touch for scans that lasted for a minimum of 20 minutes. There were only five patients out of 60 participants whose scans lasted less than 20 minutes. Hence, the researcher was not able to provide the intervention for the full 20 minutes in these cases. The researcher used the reference sheet that had all the steps of foot massage while providing the intervention (Table 1). The researcher was able to follow the protocol to full extent. There were no barriers to the application of the intervention protocol. As there are no other studies on the feasibility of using integrative approaches to interventions (foot massage, touch or presence) in the MRI setting, there is a lack of data in the literature for comparison.

**Aim Three: Participant and Provider’s Acceptability of the Interventions**

As discussed before, there were four factors that determined participants’ acceptance of the interventions during MRI: (a) participants’ comfort during treatment; (b) participants’ acceptance of the length of the treatment; (c) participants’ evaluation of effectiveness of the intervention; and (d) participants’ recommendation of treatment as part of routine MRI care. Results from this study indicate that foot massage or touch interventions were acceptable to both participants and MRI technologists to decrease participants’ anxiety during MRI.

**Participants’ Comfort During Treatment**

All the participants in this study felt comfortable during the treatment. The participants who had a mirror on the head frame during the MRI were able to see the researcher during the scan. There were two participants who became concerned for the researcher. One participant in
the presence group expressed that the researcher looked anxious while another participant in the same group said that the researcher must be cold during the MRI. Based on the participants’ feedback, the researcher had her arms covered with a warm blanket and tried to give a calm appearance by keeping her eyes closed on occasions. Participants’ concern in these cases indicates less concern for themselves and more for the researcher, demonstrating the effectiveness of the intervention to relieve their own anxiety.

Participants’ Preference Regarding the Length of the Treatment

The length of the intervention was just right for the majority of the study participants 75%. However, 8.3% of the participants mentioned that they would have preferred the intervention for the length of the scan. There are no studies to date examining integrative approaches to interventions such as foot massage, touch, or presence in MRI settings. However, several have reported the use of 10- and 20-minute long foot massage sessions during hospitalization (Grealish, Lomasney, & Whiteman, 2000; Hattan, King, & Griffiths, 2002; Hayes and Cox, 1999). One participant in the foot massage group said, “Time went by faster, it really calmed me down. Once the massage stopped, I felt that I was back in the same environment – loud and enclosed space. The foot massage relaxed me and took my mind off the noise and everything. Everything was very effective. I wish that I had had the foot massage for the whole length.” A patient in the touch group preferred the legs to be touched throughout the scan.

Other studies have used physiological and psychological measures to determine the effect of foot massage (Abdelaziz & Mohammed, 2014; Grealish, Lomasney, & Whiteman, 2000; Hattan, King, & Griffiths, 2002; Hayes and Cox, 1999). Future studies should focus on comparing the effect of different lengths of integrative measures (foot massage and touch) on anxiety during MRI. Also, these studies should incorporate physiological measures in addition to
the psychological measures to determine the length of session that will be the most effective for the patients undergoing MRI.

**Participants’ Evaluation of Effectiveness of the Intervention**

There was a significant difference among the three groups in terms of effectiveness of the intervention ($F = 15.19, p < .001$), although the repeated measure ANCOVA analysis on effect of interventions on anxiety revealed that there was no significant group or group by time difference in anxiety. The participants themselves rated touch and foot massage intervention as more effective than presence. According to Lazarus’ theory of stress and coping, reappraisals occur continuously as the situation evolves by re-evaluating, changing, or re-labeling earlier appraisals. A person may experience a reduction in perceived threat due to the identification or discovery of additional personal resources to deal with the event (Lazarus & Folkman, 1984). Such findings indicate that these interventions helped the participants with the reappraisal process which was influenced by calming effect of integrative interventions. Foot massage or touch were additional resources for participants to cope with their MRI examination experience. These findings validate Lazarus’ theory of stress and coping.

**Participants’ Recommendation of Treatment**

Majority of the participants (81.7%) recommended foot massage, touch or presence to be part of routine MRI care. One participant stated, “Foot massage relaxes you. It just gives you the soothing relaxing feeling, takes the mind off the scanner, I was more focused on the massage strokes, please keep doing this in practice.”

Another patient felt more trapped in the beginning as touch was applied, but soon after he felt that the touch was taking his attention off the noise and enclosed space. This patient
mentioned that he would not have completed the scan had it not been for the presence of the researcher.

Yet another patient from the touch group reported that in the past, “my mind start spinning as I would always be in pain. This time I really enjoyed the MRI. Touch was soothing and great. I almost fell asleep.” One patient from the presence group who had had several MRIs before and who usually kept her eyes covered with a small towel mentioned, “This time, the mirror on the head really helped me stay calm. This was a better MRI experience - actually this was the best MRI. The nice, calming appearance of the researcher really helped. This is a nice option for someone who never had an MRI before.”

About 11.7% recommended that the use of these interventions should be according to patient preference. One patient stated that “foot massage should be according to patient preference. Time went faster; it completely took my mind off from what was going on, and it was very relaxing.” Another patient mentioned that one of her hips and the side of her back was very tight but it relaxed after she received the massage. She asked if she could be scheduled for another scan to get another foot massage. She did mention that foot massage is not necessary. However, “pampering makes anyone feel better. This was very nice.”

Two participants (10%) in the presence group mentioned that the presence of the researcher did not make any difference. These participants missed being touched during the scan. One participant in the presence group commented, “Presence was good but rubbing legs would have been better.” Another patient said that the researcher’s presence did not matter. This patient stated that, “If it was my husband present with me, it would have been a better experience as he would at least touched me and touch could have helped.” Another patient mentioned that the researcher’s presence did not matter. This patient recommended that touch would have been
better because it would have distracted him from the pain and noise. Based on these patient’s remarks, there is an indication that presence alone may not provide enough intervention and that interventions such as touch and/or massage may be more effective.

**MRI Technologists’ Acceptability**

One survey of radiographers found that 71.6% reported that patient anxiety was an issue for MRI scans (Tischler, Calton, Williams, & Cheetham, 2008). Radiographers have reported that disruptions of scans due to anxiety are still prevalent, despite the use of information provision, music, communication with radiographers, and sedation (Tischler et al., 2008). Tischler concluded that there is a need for more patient support in order to improve patient experiences and lower the costs of disruptions due to anxiety. This finding from the literature may explain the fact that these MRI technologists working in the field were very supportive throughout this study being aware of patient anxiety as an issue with MRI scans. Some of them even offered to be present with the patients who were not part of the study during MRI.

**Aim Four: Effect of Body-based Interventions on Anxiety Levels During MRI**

There can be several reasons for anxiety during MRI such as claustrophobia, fear of getting hurt, fear of suffocation, fear of the unknown and fear about results (Katz, Wilson, & Frazer, 1994). Patients at CNS described the loud and enclosed space as making them feel isolated. A patient from the touch group stated, “Usually I feel like I am in a cave and can’t breathe.” Another patient expressed that in the beginning, he felt more trapped as touch was applied. But soon, he felt that the touch was taking his attention off the noise and the enclosed space and that he would not have completed the scan had it not been for the presence of the researcher.
In addition, MRI related anxiety can cause unintentional motions such as coughing and shifting legs during the exam resulting in image degradation/motion artifacts (Ali, Modic, Mahmoud, & Jones, 2013; Murphy & Brunberg, 1997). The researcher observed participants from all three groups shifting their legs at times during the procedure. Some patients from the touch and foot massage groups were also observed shifting their legs especially after 20 minutes of interventions had stopped. The researcher did follow up with the MRI technologist to check if the movement caused artifacts and if the technologist had to repeat the sequence. There were artifacts but not all sequences needed to be repeated.

A single application of massage therapy has been found to be effective in decreasing state anxiety ($g = 0.37, p < 0.01$) (Moyer et al., 2004). Another study by Hattan, King and Griffiths (2002) revealed a significant effect of a 20 minute foot massage on self-reported calmness in patients after a coronary artery bypass graft surgery. In this study, there was a significant decrease in anxiety with foot massage. The anxiety score of the foot massage group at the end of the MRI scan remained lower than that of the other groups. However, as there are no studies to date examining presence, touch and foot massage as interventions in MRI settings, several have reported that the use of massage during hospitalization decreases anxiety (Grealish, Lomasney, & Whiteman, 2000; Hayes & Cox, 1999) as well as decreasing anxiety for postoperative patients (Bauer, Cutshall, Wentworth, Engen, Messner, Wood & Sundt 2010; Degirmen, Ozerdogan, Sayiner, Kosgeroglu, & Ayranci, 2010; Ucuzal & Kanan, 2014; Wang & Keck, 2004).

Although there was no significant decrease in anxiety among patients receiving touch, repeated measure ANCOVA analysis revealed that there was a non-significant decrease in anxiety across time with touch. Lindgren et al. (2010) found that caring touch reduced heart rate and maintained the balance of the autonomic nervous system in healthy volunteers. This
mechanism of decreasing sympathetic nervous system activity and inducing a compensatory
decrease in parasympathetic nervous activity gives support for “how” touch might have helped
decrease anxiety.

Limitations

This feasibility study had several limitations that can potentially affect its
generalizability. Limitations included selection bias, sampling bias, group assignment, presence
of extraneous variables, convenience sampling and non-randomization.

The majority of the participants (58%) were Caucasian with approximately 1/3 of the
sample Hispanic (32%). This study did not include a diverse population such as African
Americans, Asians, and Native Americans, a population demographic that is similar to the
Tucson locality. The majority of the participants scheduled at CNS had a previous MRI. The
participants having an MRI scan for the first time were not included which limits the
generalizability to the participants with a previous MRI.

The sample size for this study was only 60 because the power for this study was
calculated using repeated measures ANOVA as a statistical test. Also, large effect size was used
to conduct power analysis which impacted sample size. Repeated measures analysis revealed that
the effect size was small. The multilevel modeling was found to be a better data analytic
technique for this study. As a general rule, Kreft (1996) recommends 30 units per cluster for the
required sample size for multilevel models, which means that a sample size of 90 was needed to
run the three level multilevel modeling. Given the concerns for power, a two level model was
used, using the interventions (foot massage, touch) as predictors and presence as a comparison
group. For this study, a larger sample size would have been more revealing.
The participants were asked to select a packet out of three packets (one for each group) on the day of MRI examination after they were screened. The order of the packets varied for each participant. When one group had 20 participants, the participant chose from the remaining group(s) until there were 20 participants in each group. There was not an equal chance (probability) of getting assigned to one out of three groups for all the participants.

Once the packet was selected, the participant was told his/her group assignment. Knowledge of group assignment might have affected their baseline anxiety level and their anxiety level at different times to different interventions. Participants were aware of the group they were assigned to before their baseline anxiety was measured and also before they were taken to the MRI suite. It can be that the participants’ lower level of baseline anxiety in the foot massage group was related to mere knowledge that they belonged to the foot massage group.

One participant in the presence group commented, “MRI technologist had very soothing voice. A combination of her soothing voice, ear plugs and the presence helped me complete the scan.” It was more than just the presence of the researcher that attributed to the decrease in the anxiety level for this participant. Also, participants undergoing head scan always had a mirror on their head while others were given an option to use the mirror by the MRI technologist. Not all participants opted for the use of a mirror. It is not clear whether the ability to see the researcher and or the surroundings of the MRI examination room during MRI made any difference in the anxiety level. Other extraneous variables may have affected anxiety level, extraneous variables that were not measured.

In this pilot study, a convenience sample was drawn from a community neuroscience center. Participants from other hospitals or MRI centers were not included. Also not all possible age groups and races were included. Although the trends on effect of the integrative approaches
to intervention on anxiety were identified, the lack of randomization undermines the ability to generalize the results of this study to other MRI settings or to the entire MRI patient population.

**Implications for Future Studies**

Further research is needed to determine if use of a mirror that enables the patient to see surrounding can become a standard practice for all MRI patients. In the current study, one patient in the presence group who was very anxious was able to complete the scan because he was able to see the researcher and his surroundings. Not all patients are provided the option of using the mirror.

Further research is needed that includes patients undergoing MRI for the first time. Comments from participants in the current study indicate that they may benefit from integrative therapies as well. In addition, the length of the intervention provided, for example a specified period or throughout the scan, needs to be studied.

Given that patients reported benefits from these integrative approaches, further study as to the applicability of integrative measures in other hospital settings and/or during other diagnostic testing is also warranted. In addition, for young children having an MRI, the use of integrative measures needs to be explored.

In the current study, group assignment was provided to the participants prior to measurement of baseline anxiety. In those assigned to the foot massage group, baseline anxiety was lower than the other groups. Future studies are needed that include a group that is not provided with group assignment to determine if knowledge that they are assigned to the foot massage group was responsible the lower anxiety scores.

Finally, a comparative study needs to be conducted in order to determine the effects of using integrative interventions either in lieu of, or in addition to, sedation. This study will assess
the extent to which touch and/or presence will be of benefit in reducing anxiety during MRI for patients who request sedation. There were two anxious patients whose responses indicated the need for this continued study. One forgot to take her medicine before her scan. She was afraid of noise and enclosed spaces, including the noise of public buses and traffic. She mentioned that she cannot even stay in an elevator. She was able to complete her scan with touch intervention even though in the past she had always required sedation. The second patient had called the day before the procedure and told the scheduler that he was anxious about the scan and needed medication to complete the scan. However, for some unknown reason, the sedation was never prescribed. He participated in this study and was able to see the researcher through the mirror placed on his head frame. The patient said that during his previous MRI, he could not see anything. This time with the presence of the researcher and the mirror, his anxiety decreased and he was able to complete the scan.

Future studies should also focus on comparing the effect of different lengths of integrative measures (foot massage and touch) on anxiety during MRI. This study used only psychological measures to examine the effect of integrative approaches to interventions. Use of physiological measures in addition to the psychological measures to determine the length of intervention that will be the most effective for patients undergoing MRI should be studied. Also, physiological measures should be used to compare foot massage and touch interventions.

It can be challenging to provide massage while there is an ongoing loud noise. Future studies can explore if touch or massage provided just before MRI would be as effective as touch or massage provided during the MRI.

This feasibility study used a quasi-experimental design with participants assigned to one of the three conditions: foot massage, touch and presence. Use of a larger randomized control
trial and the addition of another group receiving no intervention, including presence, may provide greater insight into the effect of integrative approaches to interventions for decreasing anxiety during MRI.

**Implications for Practice and Education**

As has been shown, the value of massage was once a recognized practice in nursing as a means of communicating caring through touch in the form of simple back rubs (Grealish, Lomasney & Whiteman, 2000; Radzyminski, 2007). This study provides evidence that even in a time of high technology integrative care should not be neglected. Implications for nursing practice do not include additional certification in the state of Arizona, but do indicate a need for additional training for providing massage to such areas of the body as the feet, hands, and head. Although generally nursing presence is not a standard of practice in the MRI setting, such nurses as are in attendance and who do have such training are well-positioned to provide a clearly needed intervention. Further implications of practice may include providing training to technologists so that they would be able to provide integrative services to their patients.

Although in the past, there were 17 state Boards of Nursing that required 6 to 27 hours of instruction in massage in the nursing curriculum (Groer et al., 1994; Jensen-Nelson, 1948), the literature lacks data on the current teaching of massage techniques in nursing curricula (Groer et al., 1994), and therefore, this is an area that needs to be addressed. If nurses are to provide integrative approaches in healthcare, then nursing students will need to receive education via nursing school curriculum on the use of these approaches. Such changes in the nursing curriculum would need to be directed from the state Board of Nursing. This education could also be provided to nurses who are already in practice as a form of professional development and/or additional certification.
Conclusion

This feasibility study has set up a foundation for future studies of integrative approaches to interventions as a complimentary therapy. The use of foot massage or touch is feasible in the MRI setting at relatively low cost. There is something to human touch that speaks to reducing anxiety much more than the physical presence especially in medical diagnostics, in which the focus is more on the use of technology for correct diagnosis of the patient rather than on the integrative care of the patient. Currently, massage, or a caring touch intervention, is simply not being performed. Patients’ comments indicate acceptability of integrative approaches to interventions and the study does demonstrate a significant effect of foot massage intervention to decrease anxiety during MRI. Given the limitations of this study, future studies are needed to address the limitations of the study and shed light on the use of integrative measures in other hospital settings.
APPENDIX A:

CORRESPONDENCE – GRANT EXEMPTION NOTICE
Date: April 29, 2015

Principal Investigator: Rajni Parmar

Protocol Number: 1304818712

Protocol Title: Feasibility of holistic interventions in reducing anxiety during Magnetic Resonance Imaging (MRI)

Level of Review: Exempt

Determination: Approved

Documents Reviewed Concurrently:
- Data Collection Tools: Anxiety measurement tool 4-10.docx
- Data Collection Tools: Demographic Information 3_22.docx
- Data Collection Tools: Master List of Contacts 3_22.docx
- Data Collection Tools: MRI technologist acceptability form 3_22.docx
- Data Collection Tools: Participant Acceptability.docx
- Data Collection Tools: Provider Acceptability Form 3_22.docx
- Data Collection Tools: Screening Tool for Determining Eligibility 3_22.docx
- HSPP Forms/Correspondence: P107_v2014-01.docx
- HSPP Forms/Correspondence: P200_v4_17.docx
- HSPP Forms/Correspondence: Signature page.pdf
- Informed Consent/PHI Forms: ICP Consent Form 4-17.pdf
- Others: References 3_22.docx
- Other Approvals and Authorizations: Site approved letter.pdf
- Recruitment Material: Recruitment Script 4-17.docx

This submission meets the criteria for exemption under 45 CFR 46.101(b). This project has been reviewed and approved by an IRB Chair or designee.

- The University of Arizona maintains a Federalwide Assurance with the Office for Human Research Protections (FWA #00004218).
- All research procedures should be conducted in full accordance with all applicable sections of the Investigator Manual.
- Exempt projects do not have a continuing review requirement.
- This project should be conducted in full accordance with all applicable sections of the IRB Investigators Manual and you should notify the IRB immediately of any proposed changes that affect the protocol.
- Amendments to exempt projects that change the nature of the project should be submitted to the Human Subjects Protection Program (HSPP) for a new determination. See the Investigator Manual, Appendix C Exemptions, for more information on changes that affect...
the determination of exemption. Please contact the HSPP to consult on whether the proposed changes need further review.

- You should report any unanticipated problems involving risks to the participants or others to the IRB.
- All documents referenced in this submission have been reviewed and approved. Documents are filed with the HSPP Office. If subjects will be consented, the approved consent(s) are attached to the approval notification from the HSPP Office.
APPENDIX B:

ICF CONSENT FORM
The University of Arizona Consent to Participate in Research

Study Title: Feasibility of holistic interventions in reducing anxiety during Magnetic Resonance Imaging (MRI).

Principal Investigator: Rajni Parmar, RN, MSN, PhD candidate, University of Arizona, College of Nursing

This is a consent form for research participation. It contains important information about this study and what to expect if you decide to participate. Please consider the information carefully. Feel free to discuss the study with your friends and family and to ask questions before making your decision whether or not to participate.

Why is this study being done? The overall purpose of this study is to examine the feasibility of holistic interventions in reducing anxiety during Magnetic Resonance Imaging (MRI).

What will happen if I take part in this study? If you agree to be in the study, the following will occur:

a) You will be randomly assigned to one of three groups: a foot massage intervention group, a touch intervention group or the presence of the researcher group. You will complete a brief demographics survey asking about general characteristics such as age, sex, race/ethnicity, income, marital status, medications, reason for MRI, and any other illnesses. This will take about 10 minutes.

b) You will be asked your level of anxiety before you are taken to the MRI suite. You will be positioned in the MRI scanner by the MRI technologist. You will again be asked about your level of anxiety.

c) You will be covered with a blanket during the examination and the door will be kept closed to ensure privacy.

d) If you are in the foot massage group: The researcher will wash her hands before touching your feet/lower legs. The researcher will rub her hands so that the hands are warm to touch when applying massage. A hypoallergenic massage lotion will be used for massage. You will receive a 20 minute foot massage, 10 minutes to each foot.

e) If you are in the touch group: The researcher will wash her hands before touching your feet/upper legs. The researcher will rub her hands so that the hands are warm to touch when touching your feet/upper legs. The researcher will keep her hands on your lower legs during the scan but will not massage your feet.

f) If you are in the presence group: The researcher will be present in the exam room during your MRI scan, but will not touch or massage your feet/upper legs.

g) You will be asked your level of anxiety every 10 minutes during the scan. As soon as the scan is over you will be asked about anxiety.

h) After the MRI scan is over you will be asked about your experience during the scan.
How long will I be in the study?
You will be in the study for the length of your MRI examination, which can be about an hour.

How many people will take part in this study?
Sixty (60) Individuals who meet inclusion criteria will be randomly assigned to one of three groups: 1) foot massage intervention group, 2) lower legs touch with no massage intervention group, and 3) presence of researcher with no touch or massage group. There will be 20 individuals per group.

Can I stop being in the study?
Your participation is voluntary. You may refuse to participate in this study. If you decide to take part in the study, you may leave the study at any time. No matter what decision you make, there will be no penalty to you and you will not lose any of your usual benefits. Your decision will not affect your future relationship with The University of Arizona. If you are a student or employee at the University of Arizona, your decision will not affect your grades or employment status.

What risks, side effects or discomforts can I expect from being in the study?
There are minimal risks for being in this study. Foot massage involves touching the surface of the foot. It is recognized that some people may have overly sensitive feet to touch. Occasionally a person may respond to having their foot touched by withdrawal of the foot being touched. You may discontinue participation at any time if you feel discomfort or unpleasant feelings. A non-scented hypoallergenic lotion will be used for the foot massage. You might react to the non-scented lotion. Redness of the feet is a minimal risk associated with foot massage.

What benefits can I expect from being in the study?
Human touch and foot massage can promote wellness and relaxation and may decrease MRI-related anxiety.

What other choices do I have if I do not take part in the study?
You may choose not to participate in this study without penalty or loss of benefits to which you are otherwise entitled.

Will my study-related information be kept confidential?
Efforts will be made to keep your study-related information confidential. All study materials, including the informed consent document, will be kept in a locked cabinet in the researcher’s home during the study. At the conclusion of the study, signed consent forms and questionnaires will be stored at the College of Nursing, University of Arizona. Data will be entered into a password-protected file in a password-protected computer. Efforts will be made to keep study-related information confidential. However, there may be circumstances where this information must be released. For example, personal information regarding your participation in this study may be disclosed if required by state law.
Also, your records may be reviewed by the following groups:
- Office for Human Research Protections or other federal, state, or international regulatory agencies
- The University of Arizona Institutional Review Board
- Dissertation Committee- Dr. Barbara Brewer, Dr. Mary Koithan and Dr. Cindy Rishel

What happens if I am injured because I took part in this study?
If you suffer an injury from participating in this study, you should seek treatment. The University of Arizona has no funds set aside for the payment of treatment expenses for this study.

Who can answer my questions about the study?
For questions, concerns, or complaints about the study you may contact the Principal Investigator, Rajni Parmar, RN, MSN, PhD candidate, 520-237-5308. For questions about your rights as a participant in this study or to discuss other study-related concerns or complaints with someone who is not part of the research team, you may contact the Human Subjects Protection Program at 520-626-6721 or online at http://orcr.arizona.edu/hspp.

If you are injured as a result of participating in this study or for questions about a study-related injury, you may contact Rajni Parmar, RN, MSN, PhD candidate, 520-237-5308.

An Institutional Review Board responsible for human subjects’ research at The University of Arizona reviewed this research project and found it to be acceptable, according to applicable state and federal regulations and University policies designed to protect the rights and welfare of participants in research.

What are the costs of taking part in this study?
There are no costs for participating in the study, other than your time to complete the surveys.

Will I be paid for taking part in this study?
You will not be paid for taking part in this study.

Signing the consent form

I have read (or someone has read to me) this form and I am aware that I am being asked to participate in a research study. I have had the opportunity to ask questions and have had them answered to my satisfaction. I voluntarily agree to participate in this study.

I am not giving up any legal rights by signing this form. I will be given a copy of this form.

Printed name of subject

Signature of subject

Date and time

Consent Version: 04/13/2015
Page 3 of 4
Printed name of person obtaining consent

Signature of person obtaining consent

Date and time

AM/PM
APPENDIX C:
SITE APPROVAL LETTER
February 20, 2015

Rajni Parmar, MSN, RN, PhD Candidate
University of Arizona
College of Nursing
1305 N. Martin, P.O. Box 210203
Tucson, AZ 85721-0203

Dear Rajni,

I, Marjorie Pazzi, authorize you to use Center for Neurosciences in Tucson, AZ, for the purpose of conducting your research study on application of foot massage to patients during Magnetic Resonance Imaging (MRI).

If there are any questions, please contact my office.

Sincerely,

Marjorie Pazzi
Clinical Research Director, Center for Neurosciences
APPENDIX D:

RECRUITMENT SCRIPT
Recruitment Script for Feasibility Study on Foot massage

Schedulers will be provided a print out of the following: “Hello, my name is ______. I will be scheduling your MRI. I would like you to know that currently, there is a study going at CNS on the use of holistic interventions in reducing anxiety during Magnetic Resonance Imaging (MRI) by nurse Rajni Parmar, who is a PhD candidate at the University of Arizona, College of Nursing. This study was reviewed and approved by Institutional Review Board (IRB) responsible for human subjects research at University of Arizona. If you are interested in this study, please contact Rajni Parmar to determine eligibility at 520-237-5308 or email at rparmar@email.arizona.edu.” This script will be posted at the scheduler’s desk.

Hello, my name is Rajni Parmar. I am an RN and a PhD candidate at the University of Arizona, College of Nursing. I am currently working on my dissertation looking at ways to possibly reduce anxiety during MRI. This research project has been reviewed by an Institutional Review Board (IRB) responsible for human subjects research at the University of Arizona. The IRB has found this project to be acceptable according to applicable state and federal regulations and University policies designed to protect the right and welfare of participant in research. The study will involve random assignment to one of three groups, foot massage, touch, or presence. Because of the random assignment, it is possible that you will not be in the foot massage or touch group. Instead, you will be assigned to the presence group in which the researcher will be present with you during your MRI, but will not touch or massage your feet.

If you are interested in participating you will be asked a series of screening questions to determine eligibility. After it is determined you are able to participate, you will be assigned randomly to one of the three groups: a foot massage group, a group where lower legs will be touched, but not massaged; or a group where the researcher will be present during your MRI but will not touch or massage you.

If you are interested in the study, you will be given a consent explaining the study in more detail.

You will be in the study for the length of your MRI examination visit. You will fill out a form after you are done with your scan to evaluate your acceptability to foot massage, touch or presence of the researcher during MRI. Your participation is voluntary. You do not have to participate in this study. You will not be paid to be in the study. All of the information you share will be kept confidential. I would like to assure you that this study has been reviewed and received approval from the University of Arizona Institutional Review Board for your safety.

If you decide to take part in the study, you may leave the study at any time. Do you have any questions about the study? If you have any questions later you can call me at 520-237-5308 or email me at rparmar@email.arizona.edu. Thank you for your interest and time.
APPENDIX E:
SCREENING TOOL FOR DETERMINING ELIGIBILITY
<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>No(exclude)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of screening</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Name</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (21 years or older)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Address</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Telephone number</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Have you ever had an MRI?</td>
<td>Yes</td>
<td>No(exclude)</td>
</tr>
<tr>
<td>Do you read and write English?</td>
<td>Yes</td>
<td>No(exclude)</td>
</tr>
<tr>
<td>Are you pregnant (if female)?</td>
<td>Yes (exclude)</td>
<td>No</td>
</tr>
<tr>
<td>Do you take any medication to treat anxiety?</td>
<td>Yes (exclude)</td>
<td>No</td>
</tr>
<tr>
<td>Are you currently taking any pain killers?</td>
<td>Yes (exclude)</td>
<td>No</td>
</tr>
<tr>
<td>Do you have pain in your feet?</td>
<td>Yes (exclude)</td>
<td>No</td>
</tr>
<tr>
<td>Do you have any lumps or inflammation on your feet?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Do you have any bleeding disorders?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Do you have any numbness or tingling in your feet?</td>
<td>Yes (exclude)</td>
<td>No</td>
</tr>
<tr>
<td>Have you had surgery on your feet?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Are your feet sensitive to touch?</td>
<td>Yes (exclude)</td>
<td>No</td>
</tr>
<tr>
<td>Do you have any foot swelling?</td>
<td>Yes (exclude)</td>
<td>No</td>
</tr>
<tr>
<td>Do you have any open wounds, cuts, or warts on your feet?</td>
<td>Yes (exclude)</td>
<td>No</td>
</tr>
<tr>
<td>Have you ever had a foot massage before?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>You will not have the option to listen to music during your MRI. Are you ok with that?</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
APPENDIX F:

DEMOGRAPHIC INFORMATION
ID Number  

Demographic Information

Age  

Gender  
_____ Male  
_____ Female  

Marital Status  
_____ Married  
_____ Unmarried  

Which of the racial/ethnic groups best describes you?  
_____ American Indian/Alaskan native  
_____ Asian/Asian-American  
_____ Black/African American  
_____ Hispanic  
_____ Middle Eastern  
_____ Caucasian  
_____ Other  

What is your total yearly household family income?  
_____ Less than $15,999  
_____ $16,000 - $24,999  
_____ $25,000 - $34,999  
_____ $35,000 - $49,999  
_____ More than $75,000  

Education  
_____ Elementary school or below  
_____ High School  
_____ Junior college or Vocational school  
_____ College  
_____ Graduate School  

Are you currently taking medications for Pain/Anxiety?  
_____ Yes  
_____ No  

If Yes, Name of medication: ____________________________  

When was the last time you took this medication? _____am/pm
What is the reason for MRI examination?

Any other illnesses:
APPENDIX G:

ANXIETY MEASUREMENT TOOL
ID Number ________

Anxiety Measurement Tool

On a scale of 0 to 10 with zero meaning no anxiety and 10 meaning the feeling of being terrified, what is your anxiety right now?

Anxiety score before MRI (T1) ________

Anxiety score right after the positioning (T2) ________

Anxiety score at 10 mins (T3) ________

Anxiety score at 20 mins (T4) ________

Anxiety score at 30 mins (T5) ________

Anxiety score at the end of MRI (T6) ________

Number of breaks requested by the subject during the scan ________

Length of time to complete the scan_____ mins.

Was the scan terminated?

☐ Yes

☐ No
APPENDIX H:

PARTICIPANT ACCEPTABILITY
ID Number _______

Participant Acceptability

Foot Massage Group:

Were you comfortable during the foot massage treatment:

☐ Yes

☐ No

Was the length of foot massage:

☐ Too long

☐ Too short

☐ Just right

Evaluate the effectiveness of foot massage (1-10, 10 being the best): _______

Do you recommend foot massages be part of routine MRI care?

☐ Yes

☐ No
ID Number

Participant Acceptability

Touch Group:

Were you comfortable with the touch during MRI?

☐ Yes

☐ No

Was the amount of time your feet were touched during MRI?

☐ Too long

☐ Too short

☐ Just right

Evaluate the effectiveness of touch (1-10, 10 being the best): ________

Do you recommend touch (lower legs) be part of routine MRI care?

☐ Yes

☐ No
ID Number ______

Participant Acceptability

Control group (Presence Group with no touch/foot massage)

Were you comfortable with the presence of the researcher during MRI?

☐ Yes

☐ No

Was the amount of time researcher was present during MRI?

☐ Too long

☐ Too short

☐ Just right

Evaluate the effectiveness of presence (1-10, 10 being the best): _______

Do you recommend presence be part of routine MRI care:

☐ Yes

☐ No
APPENDIX I:

MRI TECHNOLOGIST ACCEPTABILITY FORM
ID Number ______

MRI technologist’s acceptability

Were there any interruptions in the workflow: Y____ N____?
If Yes, state type of interruptions:

________________________________________________________________________

________________________________________________________________________

Did adding this intervention increase or decrease the length of MRI scan: Y____ N____?
If yes, by how much time?

________________________________________________________________________

Any other comments: ___________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
APPENDIX J:

RAJNI PARMAR FOOT MASSAGE CERTIFICATE
Rajni Parmar, RN, PhD Candidate  
University of Arizona  
College of Nursing  
1305 N. Martin, PO Box 210203  
Tucson, AZ 85721-0203

This letter is to confirm that Rajni Parmar took a three hour hands on foot massage training class in January, 2013 at University Medical Hospital. The class went through 23 techniques used on the feet of patients to relax and get circulation moving. The routine was intended to take about 5 minutes per patient to perform. I went over each technique on a demo patient, and then all the students worked on me and other students to perfect the technique. The students went home with a PowerPoint with all the techniques for them to practice to. If you have any further questions feel free to contact me.

Sincerely,

Colleen Avender, LMT
Intentional Grounding, massage by Colleen
www.massagebycolleen.massagetherapy.com
520-577-4543
Certificate of Completion

Rajni Parmar

This acknowledges that

has successfully completed

three hours of training on foot massage techniques

1/9/13

Januaray 9, 2013

Colleen Avender, LMT
APPENDIX K:

PROVIDER ACCEPTABILITY FORM
ID Number ______

Provider Acceptability Form

Was the foot massage protocol followed as written?

Y__N__ Comments: _________

Were there any constraints to implement foot massage intervention:

Y__N__ Comments: _________

Was the touch/no massage provided for 20 minutes?

Y__N__ Comments: _________

Were there any constraints for the touch?

Y__N__ Comments: _________

Was the researcher able to be present during MRI with the participant?

Y__N__ Comments: _________
REFERENCES


Loew, R., Kreitner, K., Runkel, M., Zoellner, J., & Thelen, M. (2000). MR arthrography of the shoulder: Comparison of low-field (0, 2 T) vs high-field (1.5 T) imaging. *European Radiology, 10*(6), 989-996.


