(Revised 12/07)

PURDUE UNIVERSITY
GRADUATE SCHOOL
Thesis/Dissertation Acceptance

This is to certify that the thesis/dissertation prepared

By Jennifer Leah Steiner

Entitled The Utility of the Implicit Association Test in the Measurement of Pain and Self-schema Enmeshment in Fibromyalgia Patients

For the degree of Master of Science

Is approved by the final examining committee:

Silvia M. Bigatti
Chair

Jesse C. Stewart

Leslie Ashburn-Nardo

To the best of my knowledge and as understood by the student in the *Research Integrity and Copyright Disclaimer (Graduate School Form 20)*, this thesis/dissertation adheres to the provisions of Purdue University's "Policy on Integrity in Research" and the use of copyrighted material.

Approved by Major Professor(s): Silvia M. Bigatti

Approved by: Kathy C. Johnson 5/26/10
Head of the Graduate Program Date

Graduate School Form 20
(Revised 1/10)

PURDUE UNIVERSITY
GRADUATE SCHOOL

Research Integrity and Copyright Disclaimer

Title of Thesis/Dissertation:
The Utility of the Implicit Association Test in the Measurement of Pain and Self-schema Enmeshment in Fibromyalgia Patients

For the degree of Master of Science

I certify that in the preparation of this thesis, I have observed the provisions of *Purdue University Teaching, Research, and Outreach Policy on Research Misconduct (VIII.3.1)*, October 1, 2008.*

Further, I certify that this work is free of plagiarism and all materials appearing in this thesis/dissertation have been properly quoted and attributed.

I certify that all copyrighted material incorporated into this thesis/dissertation is in compliance with the United States' copyright law and that I have received written permission from the copyright owners for my use of their work, which is beyond the scope of the law. I agree to indemnify and save harmless Purdue University from any and all claims that may be asserted or that may arise from any copyright violation.

Jennifer Leah Steiner
Printed Name and Signature of Candidate

May, 25, 2010
Date (month/day/year)

*Located at http://www.purdue.edu/policies/pages/teach_res_outreach/viii_3_1.html

THE UTILITY OF THE IMPLICIT ASSOCIATION TEST IN THE MEASUREMENT OF PAIN AND SELF-SCHEMA ENMESHMENT IN FIBROMYALGIA PATIENTS

A Thesis
Submitted to the Faculty
of
Purdue University
by
Jennifer Leah Steiner

In Partial Fulfillment of the
Requirements for the Degree
of
Master of Science

August 2010
Purdue University
Indianapolis, Indiana

ACKNOWLEDGEMENTS

There are many people who deserve thanks and appreciation for their help and support in completing this thesis. Thank you to Dr. Leslie Ashburn-Nardo for her expertise and advice on using the IAT and interpreting the IAT results, as well for her excellent ideas and improvements to my study as a whole. Thank you to Dr. Jesse Stewart for his input in how to direct my discussion section in light of null findings. Great appreciation goes out to my thesis committee as a unit for working with me to make my study the best it could be despite several setbacks and bumps in the road. I would also like to thank Dr. Dennis Ang for the opportunity to work with him and his research team, and for providing me with a subject pool. Thank you to the staff at the IU Clinical Research Center for Fibromyalgia: Janna Hilligoss and Mimi Lengerich for aiding me in recruitment of my fibromyalgia sample. Additionally, I would like to thank the staff at Clarion Diabetes Centers for allowing me access to their patients. Special thanks for my research assistants Nermin Bayman and Stephanie Case Marsh who helped with data entry. Last, but certainly not least, I would like thank my mentor, Dr. Silvia Bigatti, for her continued support, encouragement, and guidance throughout the entire life of this study. Without her I would not have been able to make this possible.

TABLE OF CONTENTS

APPENDICES

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

Steiner, Jennifer Leah. M.S., Purdue University, August 2010. The Utility of the Implicit Association Test in the Measurement of Pain and Self-schema Enmeshment in Fibromyalgia Patients. Major Professor: Silvia M. Bigatti.

Fibromyalgia Syndrome (FMS) is a chronic, painful rheumatic condition characterized by recurrent musculoskeletal pain, fatigue, and nonrestorative sleep, for which there is currently no biological marker. People who suffer from fibromyalgia are extremely susceptible to the effects of psychological stressors which may in turn exacerbate the symptoms of the disease. As unrelenting pain is the main symptom of fibromyalgia, it follows that patients would experience personal losses and changes in their self-schemas or the way in which they view themselves as a result. This study was particularly focused on identifying the enmeshment of self-schemas and pain-schemas, and the extent to which women with fibromyalgia experience pain and self-schema enmeshment (PSSE). Additionally, this study sought to determine the utility of using the Implicit Association Test as a measure of PSSE. The present study compared FMS patients to a group of diabetes patients on several measures of schema enmeshment, including the IAT. It was hypothesized that the two disease groups would differ significantly on the level of PSSE indicated by the IAT, and the two disease groups would not differ on enmeshment with illness indicated by the IAT. Additionally it was hypothesized that the IAT would be correlated with explicit measures of PSSE. Results did not support either of these hypotheses; however the sample size and statistical power necessary to test these hypotheses was severely lacking and thus they could not be evaluated in an appropriate manner. Results did not support the hypothesis that the IAT would be highly correlated with the explicit measures of PSSE. Based on these results and the existing literature, it is still somewhat unclear as to whether or not the IAT would be an acceptable/feasible tool in assessing PSSE in fibromyalgia patients

INTRODUCTION

Chronic pain is an ongoing, debilitating, and often life altering experience. It can transform a person from a functional, productive, energetic individual into a person who can no longer accomplish tasks at which they once excelled. It is no wonder that people who suffer from chronic pain may also experience a change in how they perceive and process information about themselves. Research has shown that individuals with chronic pain tend to report a sense of loss of self (Harris, Morley, & Barton, 2003; Hellstrom, 2001; Leventhal, Idler, & Leventhal, 1999) after the onset of chronic pain. This change in self-concept or self-schema has been noted in patients with chronic low back pain, post-surgical pain, arthritis, chronic fatigue syndrome, and systemic lupus erythematosus (Dickson, Knussen, & Flowers, 2008; Denton, Sharpe, & Schrieber, 2004; Harris, Morley, & Barton, 2003; Miles, Curran, Pearce, & Allan, 2005). Due in part to the prevalence of this experience, recent research has focused on the psychological processes underlying this phenomenon. Through this line of research, the schema enmeshment model of pain (Pincus & Morley, 2001) has been developed to serve as a framework for better understanding the change in self.

The Schema Enmeshment Model of Pain

Research has provided support for the idea that individuals suffering from chronic pain conditions experience a change in self-concept or self-schema. The patient's self-schema changes from one in which they were a well adjusted healthy person to a self-schema of a person who's entire life is impacted by the pain. Patients may no longer be able to separate their ideas about pain (pain schema) and their ideas about their self (self-schema). Instead the pain and self-schema may become one and the same, such that the person associates pain as an integral part of her self identity. This phenomenon has come to be known by researchers as *schema enmeshment* (Pincus & Morley, 2001). According to Pincus and Morley (2001) the schema enmeshment model of pain states that there are three components or schemas in this model: the self, pain, and illness. When these three schemas significantly overlap and become enmeshed with each other the patient becomes distressed.

Fibromyalgia Syndrome

Fibromyalgia Syndrome (FMS) is a chronic, painful rheumatic condition for which there is currently no biological marker (Wolfe et al, 1995). FMS is characterized by recurrent musculoskeletal pain, fatigue, and nonrestorative sleep. The condition affects approximately 2-7% of the general population and is more common among women over the age of 40 (Wolfe et al, 1995). Due to the lack of a biological mechanism for diagnosis, FMS is currently diagnosed based on the presence of "tender points". Tender points are small regions on the body that are sensitive or "tender" to the touch when pressure is applied; there are 18 specific tender points located throughout the body that are used to identify the disease. In order for an individual to receive a diagnosis of FMS, a rheumatologist must identify at least 11 painful tender points across several regions of the body (Wolfe et al, 1990). Due in part to the subjective nature of diagnosing this condition, patients with FMS often do not receive validation of their pain from those around them; women who suffer from this condition may feel isolated or rejected by society (Turk, 2002b). For many years Fibromyalgia was not even considered a true condition. However, the pain is very real and people with FMS are frequently hypersensitive to touch or tactile stimuli (Desmeules, Cadraschi, Rapiti, Finckh, Cohen, Dayer, & Vischer, 2004). This hypersensitivity can make simple actions like shaking hands or hugging very painful and may deter these interactions. Because chronic, unrelenting pain is the main symptom of FMS, it follows that patients would experience losses and changes in self-schema as a result.

Additionally, people who suffer from FMS are extremely susceptible to the effects of psychological stressors which may in turn exacerbate the symptoms of the disease. The prevalence of depression among individuals with FMS is significantly higher than the rates of depression among individuals with other chronic pain conditions (Hudson, Hudson, Pliner, Goldenberg, & Pope, 1985; Walker et al, 1997). The symptoms of depression have been found to contribute to an increase in pain intensity in patients with FMS (Hasset, Cone, Patella, & Sigal, 2000). Similarly, research has linked pain increases to an individual’s beliefs about the ability to control health outcomes (Gustafsson & Gaston-Johansson, 1996) and to the fear of physical activity (Turk, Robinson, & Burwinkle, 2004), both of which have been found in patients with FMS. While there is sufficient evidence that psychological factors have an impact on the physical outcomes of the disease, namely pain intensity, it is still unclear what underlying processes are involved in the psychological factors mentioned above. The enmeshment of pain and self-schemas may be related to these psychological phenomena.

The proposed study seeks to find an effective way to measure self-schema enmeshment in Fibromyalgia patients. It is important to have a proper understanding of how to accurately measure the phenomenon of pain and self-schema enmeshment (PSSE) so that future research can assess the potential association of pain self-schema enmeshment with changes in psychological symptoms in patients with FMS and related pain conditions. This study will specifically address the question: Is there an appropriate measure of (PSSE) in Fibromyalgia patients?

This proposal will review the existing literature on self-schema enmeshment in relation to chronic pain conditions, followed by an explanation of the methods by which self-schemas and self relevant information have been measured to date. Finally a methodology to evaluate the utility of the Implicit Attitudes Test will be proposed as a potential mode of measuring (PSSE).

Changes in self perception in chronic pain

Changes in self perception are common in individuals suffering from chronic illness and chronic pain. It makes sense that a person would experience a change in their thoughts about the self as chronic physical ailments are apt to have a profound impact on the daily activities of the individual. According to Leventhal (1999), chronic illness can often interfere with activities that were once easy for the individual, which creates an emphasis on what they *cannot* do. This change can in turn lead to new ways of looking at the self.

Qualitative studies have produced findings that patients feel a loss of self or identity as a result of living with their condition (Corbin, 2003; Dickson, Knussen, & Flowers, 2008). One such study of 14 chronic fatigue patients reported that individuals would separate out their life before the disease/pain onset and their life afterward as if to say that they had two different lives, or two different ideas about themselves (Dickson et al, 2008). Many of the participants reported feeling as though a part of them were missing and they were not truly themselves any longer. The participants in this study saw their illness as impacting all aspects of their lives.

A recent study used semi-structured interviews and a qualitative technique called Interpretative Phenomenological Analysis to study the effects of chronic low back pain on self identity (Smith & Osborne, 2007). Analysis of the subjects' interviews revealed several reports of inability to accept their new self. Comments such as "I can't be me" and "It's the pain, it's me" indicate a loss of self identity among these subjects. Additionally, the authors concluded that following the initial breakdown of the self-concept, further negative events were associated with the "new" self as defined by the pain.

A common feature of the change in self perception lies within the loss or death of the "past self". In a study analogous to the one mentioned above, interviews with chronic pain patients were analyzed qualitatively. Hellstrom (2001) found that subjects reported difficulties maintaining aspects of their past life and past self. Along the same lines, subjects in this study felt as though they were trapped by the present. They were no longer able to think of their lives before the onset of pain or plan for a future unaffected by chronic pain. Evidence for mourning the death of the past self has been demonstrated in other studies as well (Dickson et al, 2008; Smith & Osborne, 2007).

A similar concept to the loss of past selves is the negative *possible* self. A *possible self* is an idea of what one could become based on representations of the self in both the past and future (Markus & Nurius, 1986). Negative possible selves represent a feared potential version of the self. This appears to be a problem for those suffering from chronic pain. Chronic pain patients may look to the future and become incapable of imagining a life without pain. They may see themselves in a wheelchair or hospital bed instead of being able bodied. Consequently, this image of the future self can become incorporated into the present self (Markus & Nurius, 1986). When a person cannot visualize their condition improving, their fear of the future increases and their desire to actively combat their condition decreases. The distress associated with these beliefs can often lead to changes in an individual's self-concept (Marcus & Nurius, 1986).

In order to better understand the processes that underlie these changes in self-concept, it is important to address the role of schemas and schema enmeshment. A great deal of work on the changes in self perception has been done with chronic low back pain patients (Smith & Osborn, 2007) and general chronic pain patients (Morley, Davies, & Barton, 2005), but very little of this research has focused on FMS. The work that has been conducted with this population focuses on beliefs about self-efficacy and the impact of those beliefs on activity levels. The main finding from this line of research is that low self-efficacy in FMS patients is associated with poor performance of physical tasks (Turk, 2002b). However, this does not address how the disease itself contributes to these beliefs and other beliefs about the self. It is important to identify the changes in FMS patients' self-schemas in order to better understand how they play a role in the course of the disease.

Self-schemas and the Schema Enmeshment Model of Pain

Self-schemas are "cognitive generalizations about the self, derived from past experience that organize and guide the processing of self-related information" (Markus, 1977). Essentially, they are representations of how one perceives their self; they are at the core of how a person defines the self and their identity. Self-schemas are comprised of past experiences and behaviors that have become essential pieces of what makes the individual unique. More importantly the self-schema helps individuals to process and organize new information as either consistent or inconsistent with their "self" (Markus, 1977). Although self-schemas are rather resistant to new information that is not viewed as "self like", major life changes such as the onset of chronic pain can morph the self-schema.

One example of a morphed self-schema is the case of self-schema enmeshment. In schema enmeshment the self-schema becomes intertwined with the individual's core beliefs about other phenomena such as pain and illness (see Figure 1). Pincus developed this theory by drawing from a theoretical review of the literature of pain, illness, and self perception. The theory has been subsequently tested and researchers are now finding promising support for the model across various pain populations (Morley, Davies, & Barton, 2005). According to the model proposed by Pincus and Morley (2001) the *pain* schema is comprised of information about the actual experience of pain (Pincus &

Morley, 2001). It encompasses the sensory aspects of pain as well as the interruption of normal behaviors. A major component of the pain schema is that pain is something that ceases normal activity and signals the individual to engage in protective behaviors (Eccelston & Crombez, 1999). The *illness* schema is similar in nature to the pain schema; however the model differentiates between the two. The illness schema mainly functions to store information about the consequences of illness. Finally, the *self-s*chema contains information about the self, as discussed above.

The schema enmeshment model of pain asserts that the pain, illness, and self-schemas start out as separate entities. As pain and continuing interference with daily activities as a result of pain enter the picture, changes in the relationship between the three schemas occur. When the individual's beliefs about pain, illness, and self-start to blend together, it is called enmeshment. Complete schema enmeshment occurs when the pain and illness schema become integrated into the self-schema (Pincus & Morley, 2001). Thus the individual views pain and illness to be an integral part of the self rather than a separate experience that happens to the self. This in turn may lead to a reduced desire to engage in certain activities and have a negative impact on an individual's quality of life (Smith & Osborn, 2007). Fibromyalgia patients often experience changes in their ability to exercise, go out with friends, and execute everyday tasks such as housework (Turk, 2002b). It is possible that some of these functional challenges may be influenced by the patient's beliefs about the role of FMS in her life. As stated before, research has yet to address the changes in self-schema for women with FMS. The proposed study will assess the extent to which women with FMS incorporate their illness and pain into their definition of self and their self-schemas.

Measurement of the Self

The measurement of the self and various aspects of self-concept may be one of the more difficult tasks in the field of psychology. As of yet, the self cannot be observed nor can it be measured using psychophysiology equipment. In essence the only person who truly knows the nature of the self is the person in question. Over the years several methods have been devised in an attempt to accurately identify and measure various aspects of the self. These measures have taken both implicit and explicit forms of collecting data about the self. The utility of these different methods of measuring the self will be discussed in this section.

Traditionally, the self has been measured using self-report (Greenwald et al, 2002). Self-report measures are *explicit* forms of measurement as they generally take the form of questionnaires that a research subject or patient completes in order to provide a quantitative measurement of some aspect of self. An excellent example of this is the Rosenberg Self-Esteem Scale (Rosenberg, 1965). There are several reasons why explicit self-report measures have been heavily utilized in the study of the self. The assumption behind this type of measurement has been that the subjects must know themselves, so the best way to get information about the self must be to simply ask them. Furthermore, self-report measures have been efficient and cost-effective methods of obtaining information. However, explicit measures are not without flaws. Explicit measures are subjective in that the answers are based on the opinions, experiences, and motivations of the person completing the measure. The nature of these measures creates two major concerns: 1) subjects may not being willing to answer questions regarding personal information, and 2) subjects may not have the information or psychological insight to answer the questions accurately (Greenwald et al, 2002). Others have complained that explicit measures often tend to be lengthy and repetitive and thus are susceptible to demand characteristics (Orne, 1962) mainly that the subject may become fatigued or frustrated throughout the course of measurement and the data may be negatively impacted. Lastly and possibly most alarming, the accuracy of explicit measures may be weakened by subjects' impression management and social desirability (Weber & Cook, 1972). Subjects may not be willing to respond honestly to items that elicit a response that society has deemed weak or unacceptable. All of these factors may come into play when measuring self-schema and particularly self-schema enmeshment.

Due in part to the weaknesses of explicit methods of measurement, implicit measures have become increasingly evident in the literature over the past few decades (Greenberg et al, 2002). *Implicit* measures utilize various techniques to detect beliefs about the self in an objective way, which is less susceptible to impression management and response biases. A good deal of this research has focused on response latencies, or the time it takes to sort information. The concept underlying the use of response latency as a method of measurement is that the easier a task is, the less time it should take to make a decision about that task or piece of information (Lane, 2007). An important assumption of this theory is that information associated with the self will be easier to process than information that is discrepant from one's idea of self.

In a classic social psychology study, Markus (1977) used response latencies to examine self-schemas. In this dual-phase study, participants were given a list of adjectives that were aligned with the trait of independence and dependence. They were asked to endorse items that they felt were self descriptive. The time it took to endorse each item (response latency) was recorded. Participants were identified as "Independents" if they endorsed a greater number of independent words as self-descriptive compared to dependent words. The same logic labeled "Dependents". Those who endorsed an equal number of items were labeled "Aschematic". Examination of response latency indicated that both groups were faster at making judgments that were consistent with their self concept, meaning that Dependents had a quicker response time for dependent adjectives than for independent words and Independents were faster to endorse independent adjectives. Additionally participants labeled as either Dependents or Independents were less willing than the Aschematics to accept information that was inconsistent with their self-concept (Markus, 1977). This study provided support for both the use of response latency as a method of measurement and for the role of self-schemas. Similar studies have examined the role of self in information processing and found that people are more likely to recall information that is self-referential (Rogers, Kuiper, & Kirker, 1977). Out of early research such as that of Markus, several other methods that rely on response latencies have been developed. One of the most promising measures is the Implicit Associations Test (IAT).

Cognitive Processing of Stimuli

The IAT and other methods of implicit measurement are all based on the calculation of response latencies. It is important to understand how response latencies and implicit thoughts are related concepts. When a person is presented with a piece of information or a stimulus that they are forced to make a judgment about, there are many possibilities that must be considered before reaching a conclusion. There are two main methods of retrieving the information necessary to make these judgments. The first method, known as exhaustive retrieval, is a systematic process in which the memory is searched and each piece of retrieved information is used as a cue on how to proceed in the search (Garcia-Marques, Hamilton, & Maddox, 2002). This process is a very comprehensive way to pull information from memory; however, it takes time to complete this process. In order to speed up decision making, the brain uses short-cuts to make judgment and/or sort information. These short cuts are often called *heuristics*, they are procedures that we use automatically in order to reduce processing time (Roberts, 2004), hence the process of retrieving information using these methods is often called the heuristic method (Garcias-Marques, Hamilton, & Maddox, 2002). These short-cuts are based on previous knowledge and experience and operate much in the same way as schemas. In both cases, the brain uses generalizations to categorize information and reach conclusions in a timely manner.

The major mechanism behind the usefulness of heuristics is based on evidence from cognitive psychology suggesting that information is not stored in isolation from other pieces of information but in associative networks (Anderson, 1976). These associative networks link concepts and objects that we believe to be related to each other. A common theory that is used to explain these networks of associations is known as the *spreading activation theory* (Anderson, 1976; Ratcliff & McKoon, 1981). According to this theory, the network of memories is comprised of “nodes” which represent concepts or pieces of information. These nodes are then connected by pathways, such that concepts that are related to each other are linked together. When a person is trying to retrieve information out of the memory network, a node is activated by some stimulus in the environment and the activation is spread to other nodes in the network via the pathways that link them (Anderson, 1976; Ratcliff & McKoon, 1981). This theory has been expanded to include the assumption that the stronger the association between nodes or concepts, the more accessible this memory will be, and the shorter amount of time it should take to retrieve the information and hence make a decision (Fazio, Sabonmatsu, Powell, & Kardes, 1986). The more closely two concepts are paired together, the faster a person should be able to respond when one part of the pair is activated. A good example of this phenomenon is the free association word games that were popularized in psychodynamic psychology. If someone is given the word "peanut butter" and asked to say the first thing that comes to mind, they will likely say "jelly". It is also possible for them to say "chocolate" or "Reese's" which would be equally as valid a response however less likely as the association between peanut butter and chocolate or a particular brand may not be as direct as the association between peanut butter and jelly. It is also likely that given the time, the person may come up with several valid responses however it may take a longer amount of time to make those associations. Most measures of implicit attitudes make use of this idea of associative networks and the assumption that response latency is an indicator of the strength of the association between concepts in the network.

The IAT

The IAT is an implicit measure that is used to evaluate the strength of an association between pairs of contrasting concepts (Greenwald et al, 1998; Nosek, Greenwald, & Banaji, 2005). Concepts are broken down into categories and attributes.

Both the category and the attribute are presented as dichotomous. For example, the concepts are often self/not self, or good/bad. Participants completing an IAT are asked to sort stimuli into one of four categories. The underlying assumption is that it will be easier and thus take less time to sort stimuli that are strongly associated with each other. Under this assumption, the concepts of "expensive" and "good" have a stronger association than "cheap" and "good". Thus it will take less time to categorize the items in a condition in which the stimulus represent "expensive" and "good". Based on these principles it follows that information that is congruent with one's self-schema will be easier to sort when the stimulus represents the self.

The IAT is a computer task. Stimuli (which can be words or images) appear in the middle of the computer screen, one at a time. The participant must put the stimulus into categories that are presented on the sides of the screen. One side of the screen represents one pole of a category (e.g. self) and the opposite side represents the other (e.g. other). Categorizing the stimuli is done by pressing a key on the computer keyboard, one key for each category (e.g. "s" for "self" and "l" for "other"). The response latencies are calculated and recorded by the computer.

The IAT has traditionally has 5 steps or "blocks", however only block 3 and block 5 provide relevant data (Nosek et al, 2005). In the first block, participants sort items from two different concepts into their respective categories (e.g. "self" and "other"). The second block is similar except the participant is presented with items from two poles of an attribute such as "good" and "bad". The third block combines these first two procedures. Thus, participants may be asked to press the key on the left if the stimulus is from the category "self" OR "good" and to press the key on the right if the stimulus is from the category “other” OR “bad.” The computer alternates the categories, such that first a stimulus must be sorted into a “self-other” and the following stimulus must be sorted into “good-bad”. In the fourth block, stimuli are sorted only based on the concept categories (e.g. “self” and “other”) much like in the first block. However, this time the keys are switched such that the participant must press a key on the opposite side of the keyboard in order to sort the stimulus into a category (e.g., self is now on the right). Finally in the fifth block, participants sort much like the third block except that the keys are switched on the keyboard (see Figure 2). The computer then calculates the strength of the association between “Self” and “good” and “other” and “bad” based on an algorithm described in Greenwald et al (2002).

Assessing Explicit and Implicit Measures

Testing Reliability and Validity of the IAT

Assessing the reliability and validity of the IAT is somewhat more complex than evaluating the psychometric properties of a self-report scale due to the nature of the measure. However, many of the same principles and methods for testing reliability and validity still apply. In some studies error variance of response latencies has been evaluated as a method of assessing reliability; this is a consideration that is unique to the IAT and other tests of response latency (Buchner & Wippich, 2000). Although there are some unique factors to consider, the most common method for assessing the reliability of the IAT is a simple test-retest method (Lane et al, 2007) in which the same test is given twice to the same subject and the scores are correlated. When test-retest reliabilities of the IAT have been compared to those of other implicit measures, the IAT's reliability was found to be superior with values as high as r = .69 (Bosson, Swann, & Pennebaker, 2000).

Validity is traditionally assessed with the use of a multitrait-multimethod matrix (MTMM). The association scores on the IAT are correlated with the scores of self-report measures intended to measure the same construct. Assuming that there *is* convergent validity then the IAT should correlate highly with the measures of self-report of the same construct (Furr & Bacharach, 2008). In contrast, discriminate validity is assumed to be present if the IAT does not correlate well with measures that are thought to be unrelated to the construct. The MTMM is used to clearly chart the correlations between the various measures (see Table 4). By utilizing the methods discussed above, the psychometric properties of the IAT can be assessed and compared to that of explicit measures.

Differences between the IAT and Explicit Measures

There is some evidence to suggest that the IAT is measuring different constructs than self-report measures (Lane et al, 2007). Participants are often surprised by their scores on the IAT which may indicate that the IAT is effectively tapping into something that self-report measures cannot (Monteith, Voils, & Ashburn-Nardo, 2001). Additionally, studies that have used the IAT in comparison to self-report measures have found that the difference between the two scores can be meaningful. A commonly cited study found that individuals who scored higher on a self-report measure of self-esteem but low on the IAT had a greater degree of narcissism when compared to individuals with lower scores on the explicit measure and higher scores on the IAT (Jordan et al, 2003). This research suggests that the IAT can be used to distinguish meaningful differences, and may assess attitudes toward the self that explicit measures have failed to address.

Correlations of the IAT and Explicit Measures

Several studies have investigated the correlation between explicit and implicit measures. The research on this issue is somewhat inconclusive as the correlation between the IAT and explicit measures has varied greatly from study to study (Lane, 2007). Many studies have found the correlation between the IAT and explicit measures of self-esteem (such as self-report scales) to be quite weak (Greenwald & Farnham, 2000; Greenwald et al, 2002; Jordan et al, 2003). However, meta-analysis of IAT studies concluded that lower explicit-implicit correlations were more common among IATs of self-esteem than IATs assessing material not related to the self (Hofmann, Gawronski, Gschwender, Le, & Schmitt, 2005). This body of research provides support for the assumption that the IAT provides information about the self that cannot be obtained through self-report alone. However, it should be noted that correlations of the IAT with explicit measures in other domains have ranged from $r = -.24$ to $r = .60$ and researchers are not yet sure about the implications of this variance (Lane et al, 2007).

There are several possible explanations for the range of correlations between the IAT and explicit self report measures. One explanation is that the different types of measures are actually assessing the same construct at different points of processing (Fazio & Olson, 2003). This means that the implicit measures may be measuring the idea as it first occurs, before the individual has time to think it through and edit the content.

The role of social desirability is critical in this case. Another possible theory states that implicit and explicit measures allow access to different types of information. Smith and DeCoster (2000) have proposed that explicit measures address memory of single, specific events whereas implicit measures assess the memory of experience that has been built up or constructed overtime. This is especially relevant to the idea of self-schema change as a result of FMS because the experience of prolonged pain would be considered an idea that developed over time; thus according to this theory it may be more appropriately assessed by an implicit measure.

These findings regarding the differences in implicit and explicit measures of self-suggest that in such cases, implicit measures may be more accurate, as they bypass conscious protective mechanisms. To date, studies on self-schema enmeshment have used both explicit self-report measures and somewhat more implicit measures such as word recall tasks and sentence completion tasks (Pincus, Santos, & Morley, 2007). These findings suggest that there are discrepancies between responses on traditional self-report questionnaires and the types of tasks. Clearly, implicit measures need to be examined and their relation to explicit measures understood if we are to follow a line of valid research on the relations between self-schema and psychosocial and physical factors in FMS.

The IAT has been used extensively to study the self related to various attributes such as gender, race, and self-esteem (Greenwald & Farnham, 2000; Greenwald et al, 2002; Jordan, Spencer, Zanna, Hoshino-Browne, & Correll, 2003; Nosek et al, 2005). Despite the recent increase in the use of the IAT in detecting self related attitudes, only one study has utilized it to assess self and the processing of pain (Grumm, Erbe, von

Collani, & Nestler, 2008). The goal of that study was to determine whether the IAT could be used to differentiate between chronic pain patients and healthy controls on the basis of beliefs about the self and pain. Grumm and colleagues hypothesized that the association between self-esteem and pain would change as pain decreased as a result of a psychotherapy intervention. A group of people suffering from chronic pain was compared to a control group. All participants completed two IATs: one assessing the association between self and pain, and one assessing self-esteem. Explicit measures of self-esteem and pain were completed by all participants. The chronic pain groups then received psychotherapy treatment, and were re-assessed post-intervention. Results revealed that at baseline the chronic pain group differed from the control group on the pain IAT and showed a significantly stronger relationship between self and pain as assessed by the IAT compared to the control group. After treatment, the chronic pain group demonstrated no change in the association between self and pain on the IAT, but a there was a change on the explicit self-report measure. Based on these results the authors concluded that the IAT is useful for differentiating between chronic pain patients and controls. The increase in explicit self-esteem but not implicit self-esteem (as measured by the IAT) indicates that there may be a discrepancy between ideas about the self that are accessible to be self-reported (Grumm et al, 2008). In other words, an individual may report one feeling/opinion on a measure of self-report, but their implicit opinions may be quite different. This study is the only one of its kind; however it does provide preliminary support for the use of the IAT in assessing the pain-self relationship in chronic pain patients.

The study assessed the relationship between self and pain with explicit and implicit measures to answer the following question: *Can the IAT be used as a valid and reliable measure of pain and self-schema enmeshment in Fibromyalgia patients?* Furthermore, the study investigated the potential differences between explicit and implicit forms of measurement in regard to pain and self-schema enmeshment, which have not yet been reported in the literature. In order to evaluate whether or not the IAT was really assessing the extent to which one associates pain with self, two IATs were constructed. One IAT was designed to assess pain and self, the other assessed illness and self. In order to establish comparative validity, two groups of participants were needed; one group of FMS patients who experience pain, and a group of chronically ill patients who *do not* experience pain.

The following hypotheses were postulated for this study: 1) There will be a significant difference between self-schema pain scores in FMS and a comparison group, and 2) The difference between self-schema pain scores will be greater than the difference between self-schema illness scores in these two groups as measured by the IAT; specifically, the two groups will have similar or equal scores on the illness IAT but the FMS group will exhibit greater scores on the pain IAT, 3) Within the FMS group, the explicit-implicit measure correlations will correlate in the range of 0.30-0.35 with CMS and in the range of 0.45-0.55 with the PRISM, and given this, 4) there will be a significant difference in enmeshment as measured by the IAT and scores on the explicit measures of pain and self-schema enmeshment such that the IAT will reflect greater schema-enmeshment than the explicit measures in the FMS group.

METHOD

The research was a cross-sectional, methodological study to evaluate the utility of the IAT in measuring pain and self-schema enmeshment in FMS. Women with FMS completed several self-report measures regarding the experience of FMS and self in addition to completing the IAT. All measures were completed at the same time. There was no follow up associated with this research study. As mentioned previously, women with diabetes completed the same set of measures in order to establish that the IAT was assessing the constructs it was designed to measure and that findings were not the results of some other underlying cause. Differences between groups were evaluated to establish comparative validity. The convergent and divergent validity of the IAT was evaluated through correlations with self-report measures.

Participants and Sampling Procedures

Participants in this study were women diagnosed with Fibromyalgia Syndrome. Additionally, women with both type I and type II diabetes participated in this study. The diabetes group was intended to serve as a comparison group. Diabetes was chosen as the physical condition for comparison because like FMS it is a disease that is chronic and life altering; however unlike FMS, the disease is not always associated with great levels of pain. It was assumed that these two groups are similar in that all participants will have experience with chronic physical conditions, which in theory made women with diabetes an appropriate comparison group. An exclusionary criterion for this comparison group was the presence of chronic pain.

As the primary method of recruitment for the FMS group, participants were recruited from the existing subject pool at the IU Fibromyalgia Clinical Research Center. The IU Fibromyalgia Clinical Research Center uses a variety of methods to recruit subjects including doctor referrals, television and radio advertisements, newspaper advertisements, flyers, and a general Rheumatology recruitment database. Volunteers who are interested in studies conducted at the center complete a pre-screening survey online in which they include contact information. Research assistants at the center then contact potential participants via telephone and attempt to enroll them in various studies. Participants from previous and existing studies conducted by the center served as participants for the proposed study. Participants were contacted via telephone call and asked to participate in the proposed study. Participants were also approached face to face during visits to the center for existing appointments. Following expression of interest in the study, the women were scheduled to complete the proposed study on a day when they were already at the center for an ongoing study (see Figure 3) in order to make participation convenient for the women. In addition to increasing the convenience for the participants, scheduling in this manner likely contributed to an increased rate of recruitment as participants were more likely to show up if they do not have two separate appointment days to remember.

Inclusion criteria were as follows: 1) Participants must have received a diagnosis of Fibromyalgia Syndrome by a board certified Rheumatologist, 2) Participants must be female, 3) Participants must be between the ages of 18-65, and 4) Participants must have average pain severity score of ≥ 4 on a scale from 0-10 (this is standard inclusion criterion for research conducted at the IU Fibromyalgia Clinical Research Center). Exclusion criteria were any participant with 1) a co-morbid rheumatic disease (such as Rheumatoid Arthritis, Systemic Lupus Erythematosus, and Systemic Scleroderma) or diabetes, or 2) a body mass index (BMI) > 35. The reason for limiting maximum BMI is to ensure that pain is experienced due to the fibromyalgia and not joint pain as a result of excess weight on the joints which is a common problem for people suffering from higher BMI.

The group of women with diabetes was recruited from local endocrinology clinics and two locations of the Clarion Diabetes Center. A member of the research team approached the women face to face, informed them about the study, and asked for their willingness to participate. Those who agreed completed the study following their appointment with the nurse and/or practitioner. In addition to this method of recruitment, flyers advertising the study were distributed to all locations of the Clarion Diabetes Center as well as several local endocrinology practices; nurses and practitioners were asked to hand flyers to any patient who met criteria for the study. Lastly, a member of the research team attended local support groups to distribute flyers and inform patients of the study. Initially inclusion criteria for this group were intended as follows: 1) participants must be female, 2) participants must be between the ages of 18-65, 3) participants must have confirmed diagnosis of either type I or type II diabetes, 4) participants must have an average pain score of less than 2 on the standard pain scale (this is to ensure that they are not experiencing pain). The decision to only include average pain scores was determined based on the assumption that this was an indication of experiencing very little to no pain and thus this would not interfere with the goal of establishing comparative validity between the two IATs (the assumption being that a pain group and a non-pain group should respond differently to the tests). Exclusion criteria included: 1) co-morbid diagnosis of Fibromyalgia or any other chronic pain/rheumatic condition or, 2) a body mass index (BMI) > 35. After several months of unsuccessfully recruiting diabetes participants who met criteria, the inclusion criteria were adjusted to include participants over the age of 65 and exclusion criteria were adjusted to include women with a BMI greater than 35. These adjustments to criteria were made in an attempt to allow more women to be eligible to participate in the study and increase recruitment of the comparison group.

At the onset of recruitment it was intended that the two samples would be matched based on age, BMI, chronicity of the disease in years since diagnosis, and race. Matching groups on these variables would help to control for other factors that may play a role in any observed differences between groups. The proposed matching process made use of frequency distributions to match the groups, rather than individually matching each participant in a pair-wise manner. Matching groups in a pair-wise fashion is usually done in experimental studies when both groups come from the same population and the participants are randomly assigned to one of two groups, usually an intervention condition (Kazdin, 2003). However this was is not the case in the present research; It is difficult to match participants one-to-one when the groups are two different populations.

Matching based on frequency distributions (as was intended in the proposed research) is more efficient and appropriate for this type of study (Jackson et al, 2005). Furthermore, other studies with similar methodologies have used this method to match clinical groups to a comparison group of healthy controls (Rapacz, 1991). This methodology was also appropriate as the analyses to test the hypotheses will examine group data. Consistent with the proposed method of recruitment, the participants for the FMS group were recruited first. The frequencies for age, BMI, chronicity of disease, and race were obtained. The comparison group of women with diabetes was then recruited with the intention that the frequency of these variables would fall within the same range as the FMS group. Due to recruitment difficulties in the diabetes sample, the proposed matching procedure was impossible to complete in the manner that was intended. Instead, any diabetes patient who met criteria and expressed interest was enrolled into the study.

Setting

The study took place at several locations. All fibromyalgia participants completed the study at the IU Fibromyalgia Clinical Research Center which is located in Suite 118 at the National Institute of Sport and Fitness on the IUPUI campus. It was important that the setting for this research is convenient for the participants as many individuals in the target population have difficulty traveling due to fatigue and various other physical limitations. By using the center, participants in the fibromyalgia group were already were present to participate in existing research. The participants with diabetes completed the study at one of two locations of the Clarion Diabetes Center; one location was at the Indiana University Hospital Diabetes Center and the other was at Methodist Hospital Diabetes Center (both in downtown Indianapolis). Like the fibromyalgia group, members of the diabetes group were present at the center for an existing appointment at the time that they completed the study.

Measures

Demographics and Background Information Questionnaire

The demographics and background information questionnaire was in the form of a computerized self-report measure. Items included age, ethnicity, marital status, level of education, occupation (if applicable), children (if applicable), and years since diagnosis.

The Implicit Association Test

The IAT was used to assess implicit pain and self associations as described previously. In this study the IAT was presented and completed on a laptop computer. The content categories were “self” and “other/not self” and the attribute categories were “pain” and “pleasure” as in the study by Grumm and colleagues (2008). The IAT has been shown to yield large effect sizes when comparing groups (Hofmann et al, 2005). Additionally, test-retest reliability and construct validity has been well established using the IAT for self-esteem (Greenwald & Farnham, 2000; Jordan et al, 2003). Bosson and colleagues (2000) even went so far to say that the IAT for self-esteem has shown the highest reliability compared to other implicit measures. Based on these studies, the psychometric properties of the IAT are strong.

The Constructed Meaning Scale

The Constructed Meaning Scale (CMS) was originally developed to assess the meaning of illness among cancer patients (Fife, 1995). The CMS is an explicit self-report questionnaire (appendix A) with eight items regarding the "impact of illness on the individual's sense of identity" (Fife, 1995). Each item can be rated on a scale of 1-4. The total scale is structured so that higher scores indicate more positive associations and lower scores indicate a negative sense of what the illness means to life and identity. Items on the scale address issues such as *I feel that I am the same person I was before my illness*. The CMS was slightly modified for the purposes of the proposed study; the word "cancer" was changed to "illness". The measure has demonstrated adequate reliability and validity in medical populations of cancer patients. Reliability was assessed using both item-total correlations, all of which were significant ($p < .01$) and *Cronbach's alpha* ($r = .81$) indicating little measurement error (Fife, 1995). The CMS questions were constructed from interviews with patients (Fife, 1995).

Profile of Mood States Short Form

The Prolife of Mood States Short Form (POMS-SF) is a 30 item explicit self-report measure that assesses feelings. Items include "tense", "lively", and "uneasy" among others. Participants were asked to rate each item/feeling based on how much they have felt that way in the past week using a 5-point likert scale ranging from 0-4, with 0 =

not at all and 4 = extremely. The reliability and validity of the POMS-SF has been established in medical populations, with correlations from the original POMS all greater than *r* = 0.95. (Curran, Andrykowski, & Studts, 1995).

Chronic Pain Acceptance Questionnaire

The Chronic Pain Acceptance Questionnaire (CPAQ) is a self report measure consisting of 20 items that assess an individual’s acceptance of their pain (McCraken, Vowles, & Eccelston, 2004). Each item was rated on a 6-point scale according to how much the individual felt the statement applied to them. The scale ranges from 0-6 with 0 representing “never true” and 6 representing “always true”. This scale has been used reliably in previous research on pain acceptance (Morley et al, 2005). For the purposes of this study pain acceptance was assessed as it may moderate the focal relationship in the proposed research and this was evaluated in the analysis.

The Pictorial Representation of Illness and Self Measure

The Pictorial Representation of Illness and Self Measure (PRISM) is an explicit measure that specifically assesses the level of self and illness schema enmeshment (Buchi et al, 2002). Although the measure was originally developed to measure suffering caused to the self due to illness (Buchi et al, 2002), it became clear that the way in which suffering was defined by the authors had many similarities with the schema enmeshment model of pain and illness. Denton, Sharpe, and Schrieber (2004) evaluated this assumption and concluded that the PRISM was indeed appropriate for identifying self-schema enmeshment with illness. This is in part due to the definition of suffering which was used by the developers of the measure; the definition was far more similar to that of schema-enmeshment than to a lay definition of suffering. Buchi and colleagues (2002) definition of suffering was based on Cassell's definition that suffering is "a state of severe distress associated with events that threaten the intactness of the person…with suffering resulting in the loss of autonomy…and resulting from an inability to define one's person". The PRISM is an interactive measure of self-schema enmeshment that provides a visual representation of how individuals view themselves in relation to their illness/pain. The task includes the use of two disks, labeled "self" and "illness". Participants are asked to arrange the disks as they conceptualize their own experience with illness (appendix B). The distance between the centers of the disks is the level of Self Illness Separation (SIS). Smaller distances are associated with greater enmeshment (Buchi et al 2002, Denton et al, 2004). Although this measure may fall somewhere in between explicit and implicit in terms of the type of measure, for the purpose of this study it was considered explicit as it is assumed that the participants would have some understanding of what they are reporting.

Procedure

A member of the research team explained the study in detail to all participants. Participants were told that the study was focused on the emotional impact of living with their illness. However, the concept of schema-enmeshment was not discussed in order to avoid priming effects or biases. After any and all questions were answered, participants signed the informed consent and personal health information release.

Participants completed a questionnaire designed to assess demographics and background information, including items such as the chronicity of the disease. Two IATs were administered to all participants. The IATs followed the 7-block structure outlined by Greenwald and colleagues (2003); this is the most current format of the IAT. The second IAT was completed as a test of comparative validity and followed the same structure as the first test. This IAT was used to assess the association between self and illness (see Appendix C) as illness and pain are considered to be separate schemas in the model. Computerized versions of the revised CMS, the POMS-SF, and the CPAQ were completed. Participants were also asked to execute the PRISM task. A member of the research team followed the scripted instructions for explaining the PRISM (appendix B) as outlined in Buchi and Sensky (1999). The participant then arranged the disks to represent the way in which they saw themselves in relation to their pain. The measures were counterbalanced by type of measure (questionnaire, IAT, or PRISM) to avoid testing or priming biases. After the completion of all measures participants were debriefed (see Figure 2). It was explained that the study was interested in the extent to which individuals feel that their disease impacts their view of themselves. At this time, participants were given the opportunity to ask questions regarding the study and to ask for study findings, which will be sent to any interested participant once the thesis has been successfully defended.

Statistical Analyses

After the data was collected, all of the data was carefully examined and cleaned to ensure accuracy in the statistical analyses. Any cases that were missing data were dropped from the analyses related to the measure with the missing data. All dropped cases were taken care of using list-wise deletion. Furthermore, a reliability check was conducted on the self-report measures.

PASW 17 was used to conduct all of the analyses. The sample characteristics (demographics, background variables, etc) were examined using descriptive statistics and frequency charts. The association between concepts on the IAT was calculated by hand according to the algorithm outlined by Greenwald et al (2003). A *D* statistic for the associations assessed by the IAT was calculated for both IATs for each participant. This *D* statistic is transformed such that it can be used more like a z-score to avoid problems with individual variation of reaction times. All hand calculated *D* statistics were double checked by a different research assistant to ensure accuracy. In order to test Hypothesis 1, *there will be a significant difference between self-schema pain scores in FMS and a comparison group,* an ANOVA test was conducted. To test *Hypothesis 2*, *the difference between self-schema pain scores will be greater than the difference between self-schema illness scores as measured by the IAT; specifically, the two groups will have similar or equal scores on the illness IAT but the FMS group will exhibit greater scores on the pain IAT*, a MANOVA was conducted in an effort to conserve statistical power and follow-up ANOVA analyses were conducted for each IAT. Although it is impossible to adequately test both Hypotheses 1 and 2 given the limited sample size of the comparison group (N= 5) and greatly limited power. To test Hypothesis 3, *within the FMS group, the explicit-implicit measure correlations will correlate in the range of 0.30-0.35 with CMS and in the range of 0.45-0.55 with the PRISM*, Pearson's product moment correlations were used to assess the strength of the correlations between measures. A multitrait- multimethod matrix was created to organize the results of the correlational procedures. Lastly, to assess Hypothesis 4, *there will be differences in enmeshment indicated by the IAT and the scores on the explicit measures of PSSE such that the IAT will reflect greater schema-enmeshment than the explicit measures in the FMS group,* the scores on the pain IAT, the PRISM, and CMS were converted to z-scores with the intention of making comparisons; however it was determined that due to the nature of the measures statistical comparison of scores on the group level is not possible.

Power Analysis

A power analysis was conducted in order to determine the necessary sample size for this study to achieve adequate statistical power respective to the first hypothesis as this is the main interest of the proposed study. An ANOVA was used to assess this hypothesis. The power analysis was conducted using a computerized software package called *G-power* (Buchner, Erdfelder, Faul, & Lang, 2008). In order to achieve .80 statistical power at $\alpha = .05$ (two tailed) using an ANOVA, with two groups and an estimated effect size $f = .30$ between groups, the sample size for the proposed research needed be at least 34 participants in each group. Therefore, the total number of participants in this study was intended to be 68. All 34 participants in the fibromyalgia group were recruited; however this goal was not met in the diabetes group leaving the study underpowered which resulted in an inability to accurately test Hypotheses 1 and 2.

RESULTS

Recruitment

All participants in the FMS group were recruited through the IU Fibromyalgia Clinical Research Center. 104 women were called and informed of the study and their participation was requested. Of this group, 36 were scheduled for appointments. The members of the diabetes group were recruited through flyers as well as the clinics. It is unknown how many women many have received the recruitment flyer, however only one of the participants from this group became aware of the study through this method. During a period of three months 38 women with diabetes were scheduled for appointments at the Clarion Diabetes Centers on days that were available to the researcher. Of the 38 scheduled women, 13.2 % (five women) qualified and enrolled in the study, 52.7% (20 women) did not qualify due to a co-morbid chronic pain disorder, an exceedingly high BMI, age, or a diagnosis of gestational diabetes (see Table 1 for details), 26.3% (10 women) canceled or did not show up to their appointment, and 7.9% (three women) were not interested in participation. Three women in the diabetes group were recruited through the Methodist Hospital Diabetes Center, and one woman was recruited at the IU Hospital Diabetes Center.

Characteristics of Participants

A total of 42 women were eligible and recruited for participation in this study. Of these 36 had a diagnosis of FMS and six had either type I or type II diabetes. Within the diabetes group, one woman had type I and five were diagnosed with type II. Of the 36 women with FMS, two were excluded from the analyses as the data from their completed IATs was not useable due to program difficulties. One woman from the diabetes group was excluded due to exceeding difficulty understanding the IAT task. Thus, data from 39 participants (34 with FMS and 5 with diabetes) were included in the analyses. The demographic characteristics of both groups of participants are illustrated in Table 2. There were no significant differences between the two groups in age F(1, 37) = .060, p = .808, η^2 = .002, BMI F(1, 37) = .413, p = .525, η^2 = .011 or race F(1, 37) = 1.888, p = .178, η^2 = .049.

Experience of Pain and Chronicity of Disease

Within the FMS group, 61.8% rated their current pain level as a “5” or above, and 88.1% rated their weekly pain level as a “5” or above. The average current pain level within the group was 5.41 (*SD* = 2.19) and the average pain level for the week was 6.91 (*SD* = 1.92). The chronicity of the disease was measured in terms of years since diagnosis. The chronicity ranged from 1 year to 20 years in the FMS group, with the average years since diagnosis at 7.45 (*SD* = 6.43). Over half (52.8%) of the FMS group had been diagnosed with FMS for 6 or more years at the time of the study.

Within the diabetes group, all participants had average (current pain combined with weekly pain) pain levels under “2” as dictated by the study criteria. Three women

(60%) rated their current pain level as "2" or less, and 80% (four women) rated their weekly pain as "4" or less. 40% indicated that they experienced no pain at all (current or weekly). The average level of current pain for the group was 1.8 (*SD* = 1.79), and the average weekly pain for the group was 1.8 (*SD* = 2.49). The chronicity of disease ranged from 1 month to 32 years in the diabetes group. The average years since diagnosis was 7.13 (*SD* = 13.95), but with such a large range and so few participants this mean is questionable. Three of the five women (60%) had been diagnosed within the past year at the time of the study.

A t-test was conducted to examine the differences between groups on pain scores. As expected, there was a significant difference between groups on current pain score t = 5.345, p = .000, d = 1.725, and also on average weekly pain t = 3.507, p = .001, d = 2.628. A *t*-test was conducted for chronicity of disease as well. The Levene's test of equality of variances was significant F = 5.060, p = .031, but differences between groups on chronicity were not significant t = .087, p = .931, with a very small effect size d = .04.

Enmeshment of Self and Pain

Enmeshment as Measured by the CMS

Scores on the CMS are intended to indicate the meaning of illness to the participant, with higher scores indicating greater meaning and in this case greater enmeshment between the self and disease processes. In the FMS group, scores on the CMS ranged from 15 to 41, mean score = 24.53 (*SD* = 7.03). In the diabetes groups, CMS scores ranged from 28-38, with a mean score of 33.00 (*SD* = 4.12). ANOVA revealed that this difference on CMS scores was statistically significant F(1, 38) = 6.805, *p* = 0.013, η^2 = .572.

In order to better understand the level of enmeshment reported on the CMS in the FMS population, a one-sample t-test was run comparing the present sample to established means for both an HIV sample and a cancer sample. According to Fife (2005), the mean score on the CMS was 24.64 in the HIV sample and 33.06 in the cancer sample; these were compared to the observed mean of 24.53 in the FMS patients. T-tests revealed that there were no significant differences in CMS scores between FMS and the HIV sample (Fife, 2005), but there was a significant difference between the FMS and Fife's cancer sample such that FMS patients had lower mean scores. These results suggest that our findings are somewhat consistent with the existing data for the CMS.

Enmeshment as Measured by the PRISM

Scores on the PRISM indicate the degree to which the participant believes their pain to be a part of their self as reflected by the distance between the centers of the disc for self and the disc for pain (SIS). Lower SIS indicates greater enmeshment; the lowest possible score is a 0. Scores on the PRISM in the FMS group ranged from 0-21, with a mean of 3.33 (*SD* = 4.18). Eight women (23.5%) of the FMS participants scored a 0 on the PRISM task indicated complete enmeshment of pain and self (see Figure 4). Among the diabetes group, scores ranged from 1.50 -25 (*M* = 7.5, *SD* = 9.98). No diabetes patients displayed complete enmeshment of pain and self as measured by the PRISM. However, ANOVA revealed that there was no statistically significant difference between groups in regard to PRISM scores F(1, 38) = 2.870, *p* = 0.099, η^2 =.078, yet this lack of difference may be seen as marginally significant when sample size is and the medium effect size taken into consideration.

A simple t-test was conducted to compare scores between our FMS sample and existing samples that have used the PRISM. Denton and colleagues (2004), reported a mean of 6 in a sample of Lupus patients (a chronic autoimmune disease associated with pain). T-test revealed significant differences *t* = -4.833, *p* = .000, with the FMS sample having significantly higher enmeshment as measured by the PRISM than this other group.

Enmeshment as Measured by the IAT

The IAT produces a measure of effect size known as *D*, which is a variation on Cohen's *d*. The main difference between the two measures of effect size is that *D* values represent the "mean response latency divided by the standard deviation of all latencies that enter into the two means" (Greenwald, Nosek, and Sriram, 2006). Additionally, where Cohen's *d* can span an indefinite range, *D* ranges from -2 to 2, with 0 indicating a true midpoint (Greenwald et al, 2006). In terms of the *D*, 0 indicates an absence of an effect or no strong attitude one way or the other. In the case of this study, a *D* score that is negative would indicate less association/enmeshment of self and pain and a positive *D* would indicate greater association of self and pain.

Pain and Self IAT

Scores on the pain IAT are meant to reflect the extent to which the participant associates pain words with words about the self. Negative scores indicate greater association between self and non-pain (less enmeshment) and positive scores indicate greater association between self and pain (more enmeshment). D statistics range from -2 to 2 and are standardized. D scores closer to 0 indicate less association between concepts; values closer to -2 or 2 indicate greater association. Thus, individuals who score closer to 0 may be viewed as Aschematic or as not having strong associations between self and either category. The scores for the FMS group varied greatly, ranging from -1.03 to 0.97. The mean score for this group was -0.14 (*SD* = 0.50). A t-test comparing the mean D of the present study and the findings of Grumm and colleagues (2008), confirmed that there are no significant differences *t* = -1.869, *p* = 0.070 between findings. However, this significance is marginal as indicated by the medium effect size of *d* = -.501. Additionally a single sample t-test comparing the mean D to the point of no association e.g. 0, was non-significant *t* = -1.614, *p* = .116, possibly indicating that as a group the FMS patients did not have a strong association of self with *either* pain or no pain. The scores for the diabetes group ranged from -1.13 to 0.34 (*M* = -0.44, *SD* = 0.59) and the mean D in this group did not significantly differ from 0 *t* = -1.714, *p* = .162.

The mean *D* value of -0.1390 for the FMS group is consistent with the literature. The only other known pain IAT was studied with chronic pain patients (Grumm et al, 2008). In that study, the pain IAT yielded a mean *D* of -0.10. However, Grumm and colleagues were not interested in whether or not PSSE was present per se, rather they were more concerned as to whether or not scores on their version of the pain IAT would change as a result of a psychotherapy intervention (which they did), but the authors made no mention of whether or not the IAT was a true indication of enmeshment to begin with. Furthermore, a *t*-test of the mean *D* for the FMS group compared to the 0 point (point of no meaning) yielding non-significant results, indicates that although the findings were consistent with the literature, there may be no practical or meaningful interpretation of these scores. In other words the mean *D* does not significantly differ from 0, which implies that there is no meaningful enmeshment or association present and individuals who score closer to 0 *may* be considered Aschematic.

It is also possible that although 0 on the IAT traditionally indicates no association between self and either category, within the FMS population a score of 0 may actually indicate an elevation in association and/or enmeshment of self and pain. If negative scores indicate association between self and “no pain” then a score of 0 could potentially be interpreted as greater association/enmeshment; an association may exist but not great enough to be considered a *strong* association between self and pain. Based on this presumption, a non-pain sample would be score more negatively and closer to a strong association between self and “no pain” than a sample that experiences pain such as FMS. This was in fact the case in the present findings as the mean D for the diabetes group was more negative than that of the FMS group.

Illness and Self IAT

Scoring on the illness IAT is the same as above, with positive scores indicating greater association between illness words and self words. Within the FMS group, scores ranged from -0.51 to 0.96 (*M* = 0.13, *SD* = 0.31). There are no reported studies that made use of an IAT for illness, so there is nothing to compare these findings to. However, a *t*-test of the observed FMS group mean on the illness IAT (*M* =0.1306) and a *D* value of 0 revealed a significant difference (*t* = 2.449, *p* = 0.02). This finding can be interpreted to mean that due to the significant difference between the observed mean illness IAT score and the 0 point, that FMS patients exhibit a meaningful amount of association/enmeshment between self and illness. The scores in the diabetes group ranged from -1.42 to 0.89 (*M* = -0.23, *SD* = 0.88). A *t*- test comparing the observed scores of this group to a D value of 0 was non-significant *t* = -.233, *p* = .585.

Of interest is the fact that FMS patients appear to exhibit greater enmeshment with illness than pain as judged by the IAT (see Table 3). Not only is the mean *D* value greater on the illness IAT but according to the results of t-tests comparing the findings to a 0 or "point of no strong association", the meaningfulness of this value was deemed a significant indicator of enmeshment whereas the value from the pain IAT was not. It is puzzling that a condition that is so greatly defined by the experience of pain would produce a greater association with the concept of illness among those diagnosed with the disease. According to a recent review of qualitative studies on the experience of living with FMS (Sim and Madden, 2008), the most commonly reported symptoms among 37 studies was pain, which is to be expected. However, fatigue and lack of sleep were also reported in many studies (Cudney et al, 2002; Paulson et al, 2001) and are considered to be hallmarks of the disease as well. Anecdotal evidence from participate debriefing showed that at least two participants mentioned that fatigue was more of a problem than the pain. The present research focused on pain as the primary symptom of the disease, words associated with fatigue and other symptoms were not included in any of the measures; however it is possible that other aspects of the illness were more salient to the individuals in the FMS sample. If this is the case then this may explain why associations were greater on the illness IAT compared to the pain IAT. Future research should seek to determine which aspects of FMS are most salient for individuals suffering from the disease or if there are subsets of individuals with FMS that experience common clusters of symptoms (e.g. fatigue and pain rather than cognitive difficulties), and this research should be done in a quantitative rather than qualitative study as research of this sort is lacking.

Hypothesis 1: Differences between Disease Groups

A one-way ANOVA was conducted to examine Hypothesis 1: *There will be a significant difference between self-schema pain scores in FMS and a comparison group.* The difference between disease groups on this task was non-significant $F(1, 38) = 1.591$, $p = 0.215$, $\eta^2 = .043$. The non-significance of this analysis is not surprising as the sample size is very small, especially in regard to the diabetes group. The more underpowered a study, the less likely it is for the researcher to find a significant result, and this is especially true for attempts at establishing between group differences. A post hoc power analysis was conducted to determine the actual power of the ANOVA to find group differences according to the observed data. The power analysis used the mean scores from the IAT to calculate the actual observed power. Using a mean of -0.14 for the FMS group and -0.44 for the diabetes group, the actual observed power for the pain IAT was only 0.09. Due to the fact that a comparison of 5 cannot provide any meaningful information regarding the presence of group differences, this hypothesis cannot be appropriately tested and the result of the ANOVA should be disregarded until it is replicated with a larger sample which would yield better power.

Hypothesis 2: FMS patients will demonstrate greater PSSE

Like hypothesis 1, the second hypothesis which specifies group differences cannot be appropriately examined given the comparison group sample size of 5 and inadequate power; the following analysis demonstrates that group differences cannot be found based on the number of participants recruited for this study.

Hypothesis 2 specified that *the difference between groups on self-schema pain scores would be greater than the difference between groups on self-schema illness scores as measured by the IAT; specifically, the two groups would have similar or equal scores on the illness IAT but the FMS group would exhibit greater scores on the pain IAT.* After examining the correlations between the two IATs ($r = -.282$ in the FMS group, $r = -.681$ in the diabetes group) it was determined this hypothesis should be evaluated by MANOVA. The results of the MANOVA revealed that the overall model was significant. The Wilkes λ test of overall differences among groups was statistically significant F(2, 36) = 3.76, $p = .033$, and the Hotelling's Trace test of overall differences confirmed this finding. Although this was significant, the effect size of this finding is modest, $\eta^2 = .178$. Follow-up univariate tests showed that for the pain IAT, there was no significant differences between groups F (1, 38) = 1.591, $p = .215$, $\eta^2 = .043$ which was the same as the ANOVA in hypothesis 1. There were no significant differences between disease groups on the illness IAT either F(1, 38) = 3.402, $p = .073$, $\eta^2 = .092$. These results should be interpreted with caution and it cannot be determined as to whether hypothesis 2 was supported; further examination of this hypothesis with a larger sample is needed.

Hypothesis 3: Correlations between the IAT and explicit measures

In order to test hypothesis 3: *the explicit-implicit measure correlations will be weak within the FMS group*, Pearson's product moment correlations were conducted to assess the strength of the correlations between measures. It was specifically hypothesized that within the FMS group the pain IAT would correlate in the range of 0.30-0.35 with CMS and in the range of 0.45-0.55 with the PRISM. The pain IAT was not significantly correlated with the CMS, $r = -0.152$. The pain IAT was also *not* significantly correlated with the PRISM task, $r = -0.130$. However, the two explicit measures (CMS and PRISM) were significantly correlated with each other, $r = 0.434$, $p < 0.05$. A detailed illustration of the correlations can be seen in Table 4.

The literature states that the range for correlations between implicit and explicit measures in general is broad, yet average correlations are usually around $r = 0.20$ (Lane, 2007), thus weak implicit-explicit correlations are common. These findings have also been confirmed by Hofmann and colleagues (2005) who argue that implicit and explicit measures should not be highly correlated as they may "tap" separate and independent representations of the same construct or different constructs altogether. This is consistent with our weak correlations. However, the results do not support the specific hypothesis that correlations with the CMS would range from 0.30-0.35, and with the PRISM at 0.45-0.55.

Nosek (2005) concluded that the two different types of measurement appear to address separate but related constructs and that this relationship is moderated by several possible factors. Nosek (2005) describes four potential moderators of the relationship between implicit and explicit responses which may help explain the lack of correlation in the present study. One of these moderators is self-presentation. This has already been discussed in detail, but if the premise of implicit measures is that they are exempt from presentation bias then a difference between self-report and implicit measures is to be expected. Another possible moderator is the strength of the evaluation being made by the participant, such that stable and familiar evaluations may elicit stronger implicit-explicit correlations compared to more malleable evaluations (Nosek, 2005). For those individuals who are not experiencing enmeshment of pain and self this would explain the weak correlation, *or* if PSSE does not exist in this group this would account for the observed relationship between implicit-explicit measures in this study. The third moderator is dimensionality (Nosek, 2005) or the idea that evaluations that are more bipolar will result in stronger correlations between measures. Enmeshment with pain most likely exists on a continuum; very few individuals are either completely self-enmeshed with pain or completely self-enmeshed with “no pain”, most will fall somewhere in the middle. Due to the very fact that the evaluation in the pain IAT is not truly bipolar this may also account for the discrepancy between the implicit and explicit scores. Lastly, is the potential moderator of distinctiveness or the “magnitude of the discrepancy between one’s own evaluations and the perceived norm” (Nosek, 2005). In this case, higher correlations are indicative of the participant believing that others feel differently than they do or that their attitude is distinct from others. The participant must be aware that they are distinct in order to report this on the explicit measures thus increasing the implicit-explicit correlation. If the participant is not aware of this distinction or does not acknowledge this distinction it may reduce correlations. All of these moderating factors may play some role in the magnitude of correlations in the present study and in other studies which examine implicit-explicit correlations.

A visual representation clearly demonstrates that although the correlation is weak and non-significant, greater enmeshment measured by the pain IAT was associated with greater enmeshment as measured by the PRISM. Taken from this perspective, the positive relationship between the PRISM and pain IAT supports the presence of construct validity for the pain IAT. Additionally, the pain IAT did have a significant negative correlation with the CPAQ, indicating that higher acceptance of pain was associated with lower IAT scores and less association between self and pain. This would provide some support for the pain IAT's ability to address the construct as one could logically expect the relationship above, hence providing some minor evidence of discriminant validity.

Exploratory correlations were run between all of the explicit measures and the IATs in order to establish a clear understanding of the way in which the measures were or *were not* related. The pain IAT was not significantly correlated with the CMS or the PRISM, however it was significantly correlated with the POMS total score (r = .363) and the CPAQ (r = -.367) (see Table 4). The illness IAT was not correlated with any of the other outcomes measures. Because the CMS was the only explicit measure in the study, additional correlations were run between the IATs and individual items on the CMS in an effort to understand our findings better. There were no significant correlations between the illness IAT and CMS. However there were significant correlations between several of the CMS items and the total score on the PRISM (see Table 5). The Pain IAT only significantly correlated with one item on the CMS which read “I feel victimized by my illness.” On the other hand, the PRISM correlated with several items of the CMS indicating that there is at least some overlap in the constructs that are being assessed by these two measures. The items that the PRISM correlated with include items that pertain to not being able to live a satisfying life due to the disease, the belief that the illness has permanently interfered with reaching life goals, and that the illness has had a negative impact on the self. It appears as though the CMS is actually assessing the impact of illness or burden associated with illness, which may have some commonalities with enmeshment but may still be a distinct construct. This is further supported by the fact that although there are correlations between specific items and the PRISM, the correlations are only moderate in strength; if the measures assessed the same construct, correlations would be expected to be larger in magnitude. Based on these correlations, the convergent validity of the IAT with the explicit measures has not been clearly established. The correlations are far too weak to support that type of conclusion.

Hypothesis 4: Comparisons between various measures of enmeshment

Initially, scores on all measures of PSSE were transformed into normal distributions and converted to z-scores for the purposes of comparing the distribution of scores and testing hypothesis 4: *There will be a significant difference between scores on the IAT and scores on the explicit measures of PSSE such that the IAT will reflect greater schema-enmeshment than the explicit measures in the FMS group (scores will be higher for the IAT than for the other measures).* Yet, converting all of the scores to z-scores for comparison purposes, sets the mean score at 0 which although this works well for the IAT it does not reflect the cut-off scores of the PRISM or CMS accurately. The PRISM measure is limited by the fact that an individual cannot score lower than zero, likewise the CMS has a lower bound as well, which creates difficulty when attempting to compare it to the IAT which is scored on a continuum. Due to these differences in measurement, it is not possible to compare the amount of enmeshment indicated by each measure. Thus, hypothesis 4 cannot be tested and the findings related to this hypothesis will be discussed only in a descriptive manner.

In regard to the PRISM, a large portion of the FMS sample (23.53%) indicated complete enmeshment of pain and self with a score of 0. It would seem that based on this that the PRISM indicates a enmeshment of pain and self to a large extent, but a one sample t-test revealed that scores on the PRISM differed significantly from 0, indicating that as a group *complete* enmeshment is not present. However, as mentioned previously the scores on the PRISM in the FMS sample were significantly different from those seen in other chronic pain populations (Denton et al, 2004) and 85.3% of the FMS group indicated a level of enmeshment greater than then the average level of enmeshment reported in the literature (Denton et al, 2004). On the pain IAT, approximately 32.4% of the FMS sample (11 participants) received a score that fell beyond one standard deviation of the mean (of 0), indicating that the majority of the group scored somewhere close to the point of no strong association. Furthermore, t-tests revealed no significant difference between mean pain IAT scores and 0 as reported previously. The 32.4% who scored outside of one standard deviation above the mean, would be considered to have stronger associations with either pain or no pain compared to the rest of the group. Of this small subgroup, only six participants fell beyond the +1 standard deviation, possibly indicating a strong association between self and pain/self-pain schema enmeshment. Looking at the measures in this manner it would appear that both the PRISM and the IAT are displaying a similar pattern of a small subset of individuals indicating a noticeable degree of pain and self enmeshment. Yet, it is not possible to compare the results of these measures in a statistically meaningful way.

There is also a body of literature to suggest that the reason the IAT works is due to its ability to tap into a different part of memory than explicit measures (Smith & DeCoster, 2000); this argument has been used to explain the weak correlations between implicit and explicit measures. According to this, associations between constructs may or may not be as salient in the different part of memory. Assuming that this is true perhaps the two aspects of memory are so separate that they cannot be compared and so it makes no sense to argue that one type of measure is more or less appropriate than another or that one is a “better” measure of PSSE.

DISCUSSION

Differences between Disease Groups

The primary objective of this study was to determine if the IAT could be used to identify enmeshment of pain and self in fibromyalgia patients. In order to do this, the study sought to shows a difference between the way that pain patients (FMS) completed the IAT and the way that non-pain patients (diabetes) completed the IAT. Specifically, it was hypothesized that both groups would perform similarly on an IAT of self and illness since both conditions are chronic illnesses which would be assumed to impact the self in a similar manner. It was also hypothesized that there would be significant differences between the two groups on the pain IAT since the diabetes group did not experience pain on a regular or chronic basis. Results of the initial MANOVA revealed no significant differences between groups on either IAT. This would lead one to assume that the hypotheses were not confirmed or supported by the data. More importantly, Hypotheses 1 and 2 aimed to compare groups and this could not be accurately tested given the lack of power and the low sample size of the comparison group.

The mean scores of both groups on the IATs were examined to determine the *level* of enmeshment in each group. Mean scores on the pain IAT reveal that the FMS group scored higher on the IAT than the diabetes group, indicating a greater degree of enmeshment with pain, although this finding was not statistically significant. However this may be clinically or practically significant; FMS patient who regularly experience pain may have incorporated pain as part of their self to a greater extent than a group that does not experience pain. The MANOVA for the second hypothesis that differences between groups would be statistically significant on the pain IAT but not on the illness IAT also revealed no significant difference between groups on either IAT which was contrary to what was hypothesized. Mean D scores indicate greater PSSE among the FMS group compared to the diabetes group. These trends in the data support the notion that enmeshment of pain and self is indeed greater in pain patients compared to non-pain patients and that this difference *may* be detected using the IAT. However even though the results of the MANOVA do not support hypothesis 2, this must be interpreted with caution as the sample size of the comparison group was extremely small. Additionally, both Hypotheses 1 and 2 were not able to be tested appropriately due to recruitment difficulties.

Correlations between the IAT and explicit measures

One of the secondary goals of this study was to assess how the pain IAT behaved in relation to explicit measures of self and pain schema enmeshment. In agreement with the literature, it was hypothesized that the correlations between explicit and implicit measures would be weak as the IAT is believed to tap into a different level of the construct. The pain IAT was not significantly correlated with either the CMS or the PRISM, thus providing support for the existing literature base. It was believed that the pain IAT would correlate more highly with the PRISM in comparison to the CMS, as the PRISM is a more ambiguous task that may be considered somewhere in the middle of the continuum of explicit-implicit measures. The observed correlations do not seem to follow the hypothesized trend; the correlations between the IAT and both explicit measures were very similar in magnitude, and relatively weak.

It is possible that all of the measures are tapping into constructs that are distinct from each other yet related or similar in some way. If the measures are indeed tapping different constructs it is not possible to determine which one yields the greatest amount of enmeshment. However although hypothesis 3 was not supported by this data, the correlations *are* consistent with those reported in the literature. It is unclear as to whether this is an indication of lack of validity or if the IAT is “behaving” appropriately in relation to the explicit measures. Furthermore, the possibility that the measures may be assessing distinct constructs must be considered.

Enmeshment of Self and Pain within the FMS group

The last goal of this research was to determine which measure would yield the greatest score in terms of the amount of PSSE; more importantly it was necessary to determine which of these measures was most appropriate for the measurement of enmeshment. It was hypothesized that the pain IAT would reflect greater enmeshment than either of the explicit measures.

It has already been established in previous sections that the pain IAT did not reflect a significant or meaningful amount of enmeshment between self and pain when compared to the 0 point (the point of no enmeshment/association).

It would appear that the PRISM is the measure that demonstrates the most pain and self-schema enmeshment, as a large portion of the sample indicated complete enmeshment of self and pain on the PRISM task (see Figure 4). These findings were not supported by the results of the IAT which indicated that as a group enmeshment of self and pain was not significant. The pain IAT demonstrated that within the FMS group as a whole, PSSE was not present to a significant extent. However, based on these findings, one cannot conclude which measure is a “better” indicator of PSSE. Yet, according to the IAT alone, PSSE is not existent in our sample, but the explicit measures (particularly the PRISM) would indicate that PSSE is not only present but that it is present in a large portion of the FMS sample. The inconsistency in these findings is somewhat complicated. The results of the pain IAT may reflect that actual state of nature, suggesting that FMS patients do not incorporate pain into their self-schemas.

Finally, further research should be done to examine the convergent and divergent validity of the pain IAT for this population. Future studies should include a greater number of variables and measures to compare with the IAT. By using a greater number of measures in the search for convergent validity, we may be able to whether or not PSSE exists in this population and the IAT is not capturing this, *or* the possibility that the IAT is functioning as it should and PSSE does not exist in this population.

Potential Explanations for Null Findings

As discussed previously, MANOVA and ANOVAs of between-group differences of the IAT yielded non-significant results for both the pain IAT and the illness IAT. However, there are other possible explanations for the null findings associated with the original ANOVA in hypothesis 1 and the MANOVA in hypothesis 2.

According to Kazdin (2002), there are two major explanations for null findings in research. The first of these possibilities is that the null findings accurately represent the state of events or the way things are in reality; in other words there truly is nothing different or special going on within the sample. The other main option is that the null findings are the result of a methodological problem or error. The later possibility gives way to several other possibilities and areas of methodology in which problems may have arisen; these possibilities are outlined in this section.

Assuming the null findings represent truth

The ANOVA assessing the between-groups difference on the pain IAT was non-significant, as was the ANOVA assessing the illness IAT. If in fact the null findings represent the truth about that state of events, then it can be concluded that there is no difference in scores between the FMS group and the diabetes group on either of the IATs. This would indicate that despite hypothesized and assumed differences between the groups based on the symptoms of their disease, when it comes to completing the IAT these differences do not matter. Perhaps phrased a bit differently, this lack of difference could indicate an inability on the part of IAT to distinguish between two seemingly different groups. Under this assumption, the first hypothesis of this study would be unsupported and the validity of the IATs used in this particular study may be questioned. Conceptually, this is unlikely as it was ensured that one group did not suffer from pain and one clearly suffered quite a bit. Furthermore, the actual validity of both of the IATs used was supported by the correlations with self-report measures which were congruent with those that have been seen in the IAT literature so it is less probable that there was something innately wrong with the ability of IAT to accurately assess attitudes toward a certain construct of interest. It is more probable that the non-significant differences were due to one of the methodological issues mentioned below.

Type II Error and Inadequate Power

Inadequate power is perhaps the greatest cause for concern with this study, and it is the most probable cause of null findings with respect to finding between group differences. In accordance with the initial power analysis, 34 women were recruited for the FMS group but only five women were recruited for the diabetes group. This not only leaves a large gap between sample sizes but it creates an issue in which the study is severely underpowered. All studies are at risk for type II error, which happens when a researcher fails to reject a null hypothesis that is really false, or that the statistical test was unable to detect an effect (or in this case a between group difference) that was actually in existence (Gravetter and Wallnau, 2007). Studies with small samples or that are underpowered are especially at risk for type II errors. Type II errors commonly occur when the treatment effect is very small, or too small to fall within the critical region; however this does not mean that the effect is not present or that it did not have an effect on the sample. In the case of the present study in which lack of power is an obvious concern, it is possible that this is the explanation that accounts for the null findings. It is difficult to imagine finding any true group differences, when one group is a sample as small as n = 5. Therefore, the possibility of this study being subject to type II error plausible.

Uncontrolled Error and Failure of Protocol

Kazdin (2002) suggests that some extent of null findings can be at least partially explained by what is termed as "extra noise". This term refers to various sources of variation within the actual procedure of the study. These sources can include lack of training of the research assistants/staff, differences in the method of delivery of instructions, or distractions in the environment, among others. While these are valid concerns for many studies, they do not appear to be an issue for the present research. No research assistants or staff were used to collect the data from the participants; all participants completed the protocol in the presence of and with instruction from the author. Additionally, instructions for each of the self-report measures were printed at the top of each measure to ensure consistency across all participants. Similarly, the instructions for the PRISM were scripted and memorized so that there would be no variation in presentation. Lastly, the instructions for the IAT are built into the program and appear on the initial screens prior to the beginning of the test. Due to these careful efforts to eliminate experimenter/procedural variation there is no reason to believe that variance in delivery, lack of training, or experimenter characteristics could have contributed to the finding of non-significant differences between the disease groups.

Differences between the measurement of variables

Differences in the method of measurement between independent and dependent variables may also contribute to null findings or findings that are incongruent with existing research (Kazdin, 2002). Part of the purpose of the present research was to determine if an implicit measurement tool (the IAT in particular) is a feasible and appropriate method of measuring the abstract concept of schema enmeshment. In order to test this research question it was imperative to correlate the IAT with the more commonly used measures of pain-self and illness-self-schema enmeshment which happened to be explicit types of measures. Although Kazdin (2002) makes an excellent point that the discrepancy between different methods of measurement for the same construct may lead to confusion in the data, in the present study the use of multiple types of measurement tools was an integral part of establishing the validity of the IAT for the specified purposes. As discussed, the correlations between the pain IAT and both the CMS *and* the PRISM were very weak; although the correlations were indeed weaker than those hypothesized, they seem to be consistent with the literature on the IAT.

Some discussion regarding the actual content of the scales may be appropriate and may have also contributed to weak correlations. For example, the CMS appears to address issues of illness or disease more so than pain, and so it would follow that the correlation between a pain measure and the CMS would be not as strong. It may also be that the CMS addresses the construct of illness impact on life as a whole more so than illness impact on the self. It has already been established above that the correlations between individual items of the CMS and the PRISM were only moderate and that this may indicate that they are assessing different constructs, which may interfere with the ability to examine construct validity. The possibility that the CMS and PRISM assess different psychological constructs is further supported by the fact that at face value the items on the CMS appear to address burden of illness or overall meaning in illness rather than enmeshment. A sample item on the CMS may illustrate this point. *My illness has a negative effect on the things I value most about myself* is one of the items. Although this item may be related to enmeshment it does not address enmeshment with the illness itself. Furthermore, the issues associated with correlating implicit and explicit measures of the same concept have already been addressed and the findings of the present study are consistent with the literature on these issues (Hofmann et al, 2005; Lane, 2007). With the exception of Grumm et al (2008), there is little to no research that has used the IAT to assess the association between self and pain, and no IAT on self and illness has been found in the literature. Due to the novel use of the IAT in the present research, it is difficult to determine whether or not the null findings are incongruent with existing findings, as there are none available for comparison.

Study Limitations

No study is without limitations; the probable issues associated with the proposed study are outlined in this section.

Recruitment Difficulties

As mentioned previously, recruitment of the comparison group was difficult. Recruitment efforts spanned approximately 6 months and included flyers in several local doctors offices, visits to support groups, and at least 10-12 hours a week for over two months spent in the Clarian Diabetes Centers. Despite many attempts, only five diabetes patients completed the study (only six were recruited). There are several plausible reasons as to why recruiting in this particular population may have been difficult.

First, it is highly likely that due to the strict inclusion/exclusion criteria of the study many patients who would have otherwise been interested in participating may not have been eligible. In fact 45.5% of diabetes patients who were approached did not qualify due to one of the criteria; 9.1% of these patients were disqualified due to a co-morbid chronic pain disorder. This numerical representation is only among those that were approached at the diabetes centers; an even greater number of potential participants may have seen the study flyer and decided on their own that they did not meet qualifications. Prior to initiating this study, the high rate of co-existing pain conditions in diabetes patients was not considered, although research provides evidence that as much as 60% of diabetics have co-morbid chronic pain (Krien, Hiesler, Piette, Makki, and Kerr, 2005) in some samples. Clearly due to neuropathy and similar diabetes-related health problems, pain is a greater issue in this population than was thought.

Secondly, the Clarian Diabetes Centers may not have been the most appropriate location for the recruitment of subjects for this particular study. Many of the patients at the centers were there to receive education/treatment for gestational diabetes. These patients were excluded from the study due to the temporary nature of their condition.

Furthermore, both diabetes locations have a large number of cancelations and no show appointments. According to the personal opinions of the staff at these locations, it is assumed that the distance from the suburbs to downtown Indianapolis and the expense of parking are common deterrents to attending scheduled appointments.

Thirdly, the diabetes patients who were approached at the centers came with a set agenda for the day: to attend their appointment (which could last up to two hours). It is possible that some people refused to participate simply because they were tired or overwhelmed or in a hurry to leave the center after such a long visit. Lastly, the participants in this study did not receive much compensation for their time and this may have contributed to a belief that it was not worth their time to participate.

There are several reasons why these issues did not arise in the recruitment of the FMS sample. The FMS sample was recruited from a list of women who had already participated or expressed interest in participating in research related to FMS. Furthermore, many of these women had an existing relationship with the IU Fibromyalgia Clinical Research Center, and this may have contributed to a willingness to participate. Additionally, speculation on the part of the researchers at the IUFCRC, believe that many of their participants have an internal motivation to participate in FMS related research as they are used to not receiving the validation that they seek. All of these factors may have played a role in the relatively fast recruitment of FMS patients in comparison to patients with diabetes.

Volunteer Bias

Volunteer bias is a major concern regarding the external validity of this study. Although the research utilized a clinical sample of Fibromyalgia patients and a very small clinical sample of diabetes patients, it is possible that there is something fundamentally different about the women in the samples and the overall clinical populations from which they were derived. First, the research included only women, as FMS is a disease that primarily affects women. However, this makes results difficult to generalize to males with FMS. Secondly, it has been the clinical experience of the staff member of the IU Fibromyalgia Clinical Research Center that volunteers of the studies conducted at the center are often among the higher functioning group of FMS patients. There is no hard evidence to support this notion, however it should be considered that as a result of this trend the proposed research may miss a subset of the population. In relation to the diabetes sample, it is unlikely that such a small sample could be considered representative of this population; due to this not only are results not generalizable to greater populations but the likelihood of this small sample being fundamentally different is high. Based on the fact that so many diabetes patients did not meet criteria for this study, it may suggest that the sample we were *looking* for is not in existence and hence would not be representative.

Demand characteristics

Demand characteristics may possibly have been a threat to this study. The IAT requires a certain level of cognitive understanding as well as a relatively quick reaction time. Additionally, it can be difficult to understand the directions for the various blocks of the test. This presents an issue when working with FMS patients. Individuals with FMS often suffer from cognitive deficits and a decrease in ability to move quickly as a result of their condition (Turk, 2002b). These factors could have had profound impact on the results of the IAT, both in terms of accuracy of responses and response latency. However, the directions for the IAT were explained carefully and clearly as many times as necessary in order to enhance understanding of the task. None of the IAT data collected from the FMS sample had to be discarded due to exceedingly long response latencies, indicating that the anticipated deficits in this group may not have been as great an issue as expected.

Confounding Variables

There are a few factors that may potentially confound the findings of this study. The level of pain intensity at the time of assessment could be a confounding variable. It would make sense that if the participant was in a great deal of pain on the day of the assessment that she may respond in a manner that reflects this pain, which may or may not be consistent with her normal experience of the disease. The participant’s levels of social support and the quality of interactions with family may impact her view of herself. Depending on how the family has approached the situation surrounding the illness, the participant may have a differing view of self. These potential confounds should be considered when interpreting the results of this study. However, the present research did not control for these variables, as it would have proven extremely difficult to recruit enough participants while controlling for these confounds.

Conclusion

The present research sought to better understand whether or not the IAT could or should be used to examine PSSE in fibromyalgia patients. It was determined that the pain IAT used in this study is able to differentiate between groups of people in chronic pain and those without. Hypothesis 1: *there will be a significant difference between groups on the pain IAT* and Hypothesis 2: *the difference between groups on self-schema pain scores would be greater than the difference between groups on self-schema illness scores as measured by the IAT* were not able to be evaluated appropriately and they were not supported. No differences emerged between groups of people in pain and those without on either of the IATs administered. Furthermore, the pain IAT did not detect a meaningful amount of PSSE enmeshment in the FMS patients; yet the illness IAT seemed to indicate that FMS patients were somewhat more enmeshed with illness in comparison to pain. The observed scores of the FMS patients on the pain IAT were not significantly different from that which has been seen in the literature, so there is support for the reliability of the test itself. The correlations between the IAT and explicit measures were weaker than those that were predicted, thus results did not support the third hypothesis. However, they do appear to be consistent with the literature on this topic. Hypothesis 4: *the IAT will reflect greater schema-enmeshment than the explicit measures in the FMS group*, was unable to be tested statistically. Descriptively, the PRISM indicated greater levels of enmeshment in the FMS patients than did the pain IAT, although this difference was non-significant. Perhaps this is due to the fact that FMS patients are not actually experiencing enmeshment of self and pain or perhaps there is something else going on, as is evidenced by the greater levels of enmeshment measured by the PRISM.

Based on the findings of this study, no strong conclusions can be drawn as to the appropriateness of the IAT for assessing PSSE in FMS patients. It remains unclear as to whether or not a difference between disease groups would have emerged if the study had been better powered. Future research should attempt to determine the comparative validity of the pain IAT, and whether or not it is truly tapping the construct of PSSE or whether participants are responding to some other factor or construct that the researcher is unaware of. There are several ways to go about determining this using the same basic study design. The first possibility would be to continue to attempt to recruit diabetes patients through other recruitment strategies that would extend beyond the greater Indianapolis region; although it can be concluded that diabetes may not be the most appropriate group for comparison due to the high rates of co-morbid chronic pain. A second strategy would be to decide upon another disease population that does not suffer from pain to serve as the comparison group. This group could be patients with hyperthyroidism which is a condition that produces serious symptoms such as excessive weight changes, but is rarely associated with pain on its own. However, the problem with this condition or any disease population is that rates of chronic pain are as high as 34% of all people (Turk, 2002a) in this country and is likely that many people will have co-morbid pain. A third option would be to use a comparison group comprised of healthy volunteers and with the assumption that the FMS group would differ significant from healthy individuals on *both* the pain IAT and the illness IAT. Any of these options would provide some means of support for the construct validity of the IAT and its ability to detect PSSE.

As hypothesis 4 was unable to be evaluated in the present study, future work should aim to determine if the IAT or the PRISM can be used as predictor measures of important physical and psychological outcomes related to the experience of FMS. An appropriate research design could assess participants at several time points and the predictive validity of the IAT or the PRISM could be evaluated and compared against each other. In this way, a more definitive statement could be made about the use of implicit and explicit measures for PSSE.

It *may* also be the case that FMS is its own entity that encapsulates both pain, disease, and the whole experience of living with FMS. Perhaps, if the enmeshment of self with *Fibromyalgia* had been examined instead of pain and illness as separate constructs, the results of the various measures would be more complementary of one another. A future study could examine the enmeshment of Fibromyalgia and self using both the IAT and PRISM. Other possibilities include examining the various symptoms of FMS that an individual may identify with rather than just pain, and the PRISM may serve as a useful format in which to explore these other symptoms and aspects of illness in which enmeshment with self may occur. Lastly, to better understand the construct of enmeshment (with pain or illness or FMS) it is imperative to understand the factors that contribute to the process of enmeshment. These factors may include depression and low self-efficacy; a clear sense of the relationship between these factors may help in determining an effective way to measure enmeshment of self with constructs related to health and specifically FMS.

LIST OF REFERENCES

LIST OF REFERENCES

Bosson, J.K., Swann, W.B.J., & Pennebaker, J.W. (2000). Stalking the perfect measure of implicit self-esteem: The blind men and the elephant revisited? *Journal of Personality and Social Psychology, 81*, 760-773.

Buchi, S., Buddeberg, C., Klaghofer, R., Russi, E.W., Brandi, O., Schlosser, C., et al. (2002). Preliminary validation of PRISM (pictorial representation of illness and self measure)- A brief method to assess suffering. *Psychotherapy Psychosomatics, 71*, 333-341.

Buchi, S., & Sensky, T. (1999). PRISM: Pictorial Representation of Illness and Self Measure. *Psychosomatics, 40*(4), 314-340.

Buchner, A., Erdfelder, E., Faul, F., & Lang, A. (2008). G Power (Version 3.0) [Computer software]. Germany.

Buchner, A., & Wippich, W. (2000). On the reliability of implicit and explicit memory measures. *Cognitive Psychology, 40*, 227-259.

Corbin, J.M. (2003). The body in health and illness. *Qualitative Health Research, 13*(2), 256-267.

Cudney, S.A., Butler, M.R., Weinert, C., & Sullivan, T. (2002). Ten rural women living with fibromyalgia tell it like it is. *Holistic Nursing Practice, 16*(3), 35-45.

Curran, S.L., Andrykowski, M.A., & Studts, J.L. (1995). Short form of the Profile of Mood States (POMS): Psychometric information. *Psychological Assessment, 7*(1), 80-83.

Denton, F., Sharpe, L., & Schrieber, L. (2004). PRISM: Enmeshment of illness and self-schema. *Psychotherapy Psychosomatics, 73*, 57-63.

Desmeules, J.A., Cedraschi, C., Rapiti, E., Baumgartner, E., Finckh, A., Cohen, P., Dayer, P., & Vischer, T.L. (2003) Neurophysiologic evidenc for central sensitization in patients with fibromyalgia. *Arthritis and Rheumatism, 48*(5), 1420-1429.

Dickson, A., Knussen, C., & Flowers, P. (2008). That was my old life; it’s almost like a past-life now: Identity crisis, loss and adjustment amongst people living with chronic fatigue syndrome. *Psychology and Health, 23*(4), 459-476.

Ecceston, C., & Crombez, G. (1999). Pain demands attention: A cognitive-affective model of the interruptive function of pain. *Psychological Bulletin, 125*, 356-366.

Fazio, R.H., & Olson, M.A. (2003). Implicit measures in social cognition research: Their meaning and use. *Annual Review of Psychology, 54*, 297-327.

Fife, B.L. (1995). The measurement of meaning in illness. *Social Science Medicine, 40*(8), 1021-1028.

Furr, R.M., & Bacharach, V.R. (2008). *Psychometrics: An Introduction.* Thousand Oaks, CA: Sage Publications, Inc.

Gravetter F.J., & Wallnau, L.B. (2007). *Statistics for the Behavioral Sciences, Seventh Edition.* Belmont, CA: Thompson Wadsworth.

Greenwald, A.G., & Farnham, S.D. (2000). Using the implicit association test to measure self-esteem and self-concept. *Journal of Personality and Social Psychology, 79*(6), 1022-1038.

Greenwald, A.G., McGhee, D.E., & Schwartz, J.L.K. (1998). Measuring individual differences in implicit cognition: The Implicit Association Test. *Journal of Personality and Social Psychology, 79*, 1022-1038.

Greenwald, A.G., Nosek, B.A., & Banaji, M.R. (2003). Understanding and using the Implicit Association Test: I. An improved scoring algorithm. *Journal of Personality and Social Psychology, 85*, 197-216.

Greenwald, A.G., Rudman, L.A., Nosek, B.A., Banaji, M.R., Farnham, S.D., & Mellott, D.S. (2002). A unified theory of implicit attitudes, stereotypes, self-esteem, and self-concept. *Psychological Review, 109*(1), 3-25.

Grumm, M., Erbe, K., von Collani, G., & Nestler, S. (2008). Automatic processing of pain: The change of implicit pain associations after psychotherapy. *Behaviour Research and Therapy, 46*, 701-714.

Gustafsson, M., & Gaston-Johansson, F. (1996). Pain intensity and health locus of control: A comparison of patients with fibromyalgia syndrome and rheumatoid arthritis. *Patient Education and Counseling, 29*(2), 179-188.

Hasset, A.L., Cone, J.D., Patella, S.J., & Sigal, L.H. (2000). The role of catastrophizing in the pain and depression of women with fibromyalgia syndrome. *Arthritis and Rheumatism, 43*(11), 2493-2500.

Harris, S., Morley, S., & Barton, S.B. (2003). Role loss and emotional adjustment in chronic pain. *Pain, 105,* 363-370.

Hellstrom, C. (2001). Temporal dimensions of the self-concept:Entrapped and possible selves in chronic pain. *Psychology and Health, 16*, 111-124.

Hofmann, W., Gawronski, B., Gschwenderner, T., Le, H., & Schmitt M. (2005). Ameta-analysis on the correlation between the implicit association test and explicit self-report measures. *Personality and Social Psychology Bulletin, 31*, 1369-1385.

Hudson, J.L., Hudson, M.S., Pliner, L.F., Goldenberg, D. L., & Pope, H.G., Jr. (1985). Fibromyalgia and major affective disorder: A controlled phenomenology and family history study. *American Journal of Psychiatry, 142*, 441–446.

Jackson,S., Marcus K., McDonald, C., Wehner, T., & Palmquist, M. (2005). *Introduction to Statistics.* Writing@CSU. Colorado State University Department of English. Retrieved [28 May, 2009] from http://writing.colostate.edu/guides/research/stats/.

Jordan, C.H., Spencer, S.J., Zanna, M.P., Hoshino-Browne, E., & Correll, J. (2003). Secure a defensive high self-esteem. *Journal of Personality and Social Psychology, 85*(5), 969-978.

Kazdin, A.E. (2002). *Research Design in Clinical Psychology, 4th Edition,* Boston, MA: Allyn & Bacon.

Keith, T.Z. (2006). *Multiple Regression and Beyond.* Boston, MA: Allyn & Bacon.

Lane, K.A., Banaji, M.R., Nosek, B.A., & Greenwald, A.G. (2007). Understanding and using the Implicit Association Test; IV; What we know (so far) about the method. *Implicit Measures of Attitudes*, 59-102.

Leventhal, H., Idler, E.L., & Leventhal, E.A. (1999). The impact of chronic illness on the self-system. In: *Self, Social Identity, and Physical Health; Interdisciplinary Explorations* (pp.185-208). New York: Oxford University Press.

Mackinnon, D.P., Krull, J.L., & Lockwood, C.M. (2000). Equivalence of the mediation, confounding, and suppression effect. *Prevention Science, 1*(4), 173-181.

Markus, H. (1977). Self-schemata and processing information about the self. *Journal of Personality and Social Psychology, 35*(2), 63-78.

Markus, H., & Nurius, P. (1986). Possible selves. *American Psychologist, 41*(9), 954-969.

McCracken, L.M., Volwles, K.E., & Eccelston, C. (2004). Acceptance of chronic pain: component analysis and a revised assessment method. *Pain, 107*, 159-166.

Miles, A., Curran, H.V., Pearce, S., & Allan, L. (2005). Managing constraint: the experience of people with chronic pain. *Social Science and Medicine, 61*, 431-441.

Miller, G.A., & Chapman, J.P. (2001). Misunderstanding analysis of covariance. *Journal of Abnormal Psychology, 110*(1), 40-48.

Monteith, M.J., Voils, C.I., & Ashburn-Nardo, L. (2001). Taking a look underground: Detecting, interpreting, and reacting to implicit racial biases. *Social Cognition, 19*(4), 395-417.

Morley, S., Davies, C., & Barton, S. (2005). Possible selves in chronic pain: self-pain enmeshment, adjustment and acceptance. *Pain, 115*, 84-94.

Nosek, B.A. (2005). Moderators of the relationship between implicit and explicit evaluation. *Journal of Experimental Psychology, 134*(4), 565-584.

Nosek, B.A., Greenwald, A.G., & Banaji, M.R. (2005). Understanding and using the Implicit Association Test: II; Method variables and construct validity. *Personality Social Psychology Bulletin, 31*, 166-180.

Orne, M.T. (1962). On the social psychology of the psychological experiment: With particular reference to demand characteristics and their implications. *American Psychologist, 17*, 776-783.

Paulson, M., Danielsn, E., Larsson, K., & Norberg, A. (2001). Men's descriptions of their experience of nonmalignant pain of fibromyalgia type. *Scandinavian Journal of Caring Sciences, 15*(1), 54-59.

Pincus, T., & Morley, S. (2001). Cognitive-processing bias in chronic pain: A review and integration. *Psychological Bulletin, 127*(5), 599-617.

Pincus, T., Santos, R., & Morley, S. (2007). Depressed cognitions in chronic pain patients are focused on health: Evidence from a sentence completion task. *Pain, 130*, 84-92.

Rapacz, K.E. (1991). Human patterning and chronic pain. *Dissertation Abstracts International* (UMI No: 9134293).

Rogers, T.B., Kuiper, N.A., & Kirker, W.S. (1977). Self-reference and the encoding of personal information. *Journal of Personality and Social Psychology, 35*(9), 677-688.

Rosenberg, M. (1965). *Society and the adolescent self-image.* Princeton, NJ: Princeton University Press.

Sim J. & Madden, S. (2008). Illness experience in fibromyalgia syndrome: A metasynthesis of qualitative studies. *Social Science and Medicine, 67*(1), 57-67.

Smith, E.R., & DeCoster, J. (2000). Dual-process models in social and cognitive psychology: Conceptual integration and links to underlying memory systems. *Personality and social Psychology Review, 4*, 108-131.

Smith, J.A., & Osborn, M. (2007). Pain as an assault on the self: An interpretive phenomenological analysis of the psychological impact of chronic low back pain. *Psychology and Health, 22*(5), 517-534.

Turk, D.C. (2002a). Clinical effectiveness and cost-effectiveness of treatments for patients with chronic pain. *The Clinical Journal of Pain, 18,* 355-365.

Turk, D.C. (2002b). Suffering and dysfunction in fibromyalgia syndrome. *Journal of Musculoskeletal Pain, 10*(1/2), 85-96.

Turk, D., Robinson, J., & Burwinkle, T. (2004). Prevalence of fear of pain and activity in patients with fibromyalgia syndrome. *The Journal of Pain, 5*(9), 483-490.

Walker, E. A., Keegan, D., Gardner, G., Sullivan, M., Katon, W. J., & Bernstein, D. (1997). Psychological factors in fibromyalgia compared with rheumatoid arthritis: I. Psychiatric diagnoses and functional disability. *Psychosomatic Medicine, 59,* 565-571.

Weber, S.J., & Cook, T.D. (1972). Subject effects in laboratory research; An examination of subject roles, demand characteristics, and valid inference. *Psychological Bulletin, 77,* 273-295.

Wolfe, F., Ross, K., Anderson, J., Russell, I.J., & Hebert, L. (1995). The prevalence and characteristics of fibromyalgia in the general population. *Arthritis and Rheumatism, 38,* 19-28.

TABLES

Table 1

Recruitment Efforts for Diabetes group

	Location 1: Methodist N=31		Location 2: IU N=7	
	N	Percentage	N	Percentage
Recruitment Status				
Canceled appointment	2	6.5	1	14.3
Did not show	7	22.5	0	0
Not interested	3	9.7	0	0
Did not qualify	15	48.5	5	71.4
Of those who did not qualify:				
Reason for Disqualification				
Gestational diabetes	8	25.8	2	28.6
Chronic pain condition	3	9.7	3	42.8
Age	2	6.5	0	0
BMI	2	6.5	0	0
Enrollment Rates				
Enrolled in study	4	12.9	1	14.3
Did not complete study	1	3.2	0	0
Total completed study	3	9.7	1	14.3

Note: Values are based on patients who were scheduled at the center on days that were available for recruitment. One participant was recruited through flyers and is not represented in this table.

Table 2

Characteristics of Participants

	FMS		Diabetes	
	N= 34		N= 5	
Variable	N	Percentage	N	Percentage
Demographics				
Caucasian	29	85.3	3	60
Black	5	14.7	2	40
	Mean	SD	Mean	SD
Age (years)	49.3	10.8	48.1	5.8
BMI (kg/m^2)	29.3	3.8	30.6	6.8
Chronicity	7.4	6.4	7.1	13.9
Current Pain	5.4	2.1	1.8	1.8
Weekly Pain	6.9	1.9	1.8	2.5

Table 3

Results of Outcome Measures by Disease Group

	FMS				Diabetes			
	Mean	SD	Min	Max	Mean	SD	Min	Max
Measure								
CMS	24.53	7.03	15.00	41.00	33.00	4.12	28.00	38.00
PRISM	3.34	4.18	0.00	21.00	7.50	9.98	1.50	25.00
CPAQ	65.10	10.61	43.00	86.00	72.80	13.59	56.00	86.00
POMS	40.21	18.44	15.00	86.00	15.20	13.12	-7.00	27.00
Pain IAT	-0.14	0.50	-1.03	0.97	-0.44	0.59	-1.13	0.34
Illness IAT	0.13	0.31	-0.51	0.96	-0.23	0.88	-1.42	0.89

Table 4

Multitrait Multimethod Matrix of Outcome Measures in FMS group

		CMS	**PRISM**	**POMS**	**CPAQ**	**PainIAT**	**Illness IAT**
Method	**Measure**						
Explicit							
	CMS	1.00					
	PRISM	0.43*	1.00				
	POMS	-.67*	-0.32	1.00			
	CPAQ	0.36*	0.34*	-.50*	1.00		
Implicit							
	Pain IAT	-0.16	-0.19	0.36*	-0.37*	1.00	
	Illness IAT	0.05	-0.09	0.07	-0.13	-0.28	1.00

Note: * indicates significance at α = .05

Table 5

Correlations between CMS items, PRISM, and Pain IAT

CMS item	**PRISM**	**Pain IAT**	**Illness IAT**
I feel my illness is something I will never recover from	.210	-.041	.007
I feel my illness is serious, but I will be able to return to life as it was before	.-147	.212	-.144
I often feel like an outsider because of my illness	.432*	-.165	.110
I feel that my illness is changing my life so it will never be good again	.376*	-.156	.139
I do not have the same chance for a satisfying life due to my illness	.493*	-.097	.042
I feel victimized by my illness	.439*	-.340*	-.170
I feel I am making a full recovery from my illness	-.379*	.181	-.025
The uncertainty of my illness is causing me great difficulty	.461*	-.064	-.013
I feel my relationships with others have not been negatively affected by my illness	-.219	.146	.027
My illness has permanently interfered with the most important goals I have set for myself	.413*	-.217	-.036
My illness has a negative effect on the things I value most about myself	.557*	-.182	.114

Note: * indicates significance at α = .05

Table 6

Summary of Measures

Name of Measure	Type of Measure	Format	Estimated Time to Complete Measure
Demographics Questionnaire	Explicit	Computerized Questionnaire	5 minutes
Self/Pain IAT	Implicit	Computerized Task	10-15 minutes
Self/Illness IAT	Implicit	Computerized Task	10-15 minutes
Constructed Meaning Scale	Explicit	Computerized Questionnaire	5 minutes
POMS	Explicit	Computerized Questionnaire	10 minutes
CAPQ	Explicit	Computerized Questionnaire	15 minutes
PRISM	Explicit	Interactive Hands-on Activity	5-10 minutes

FIGURES

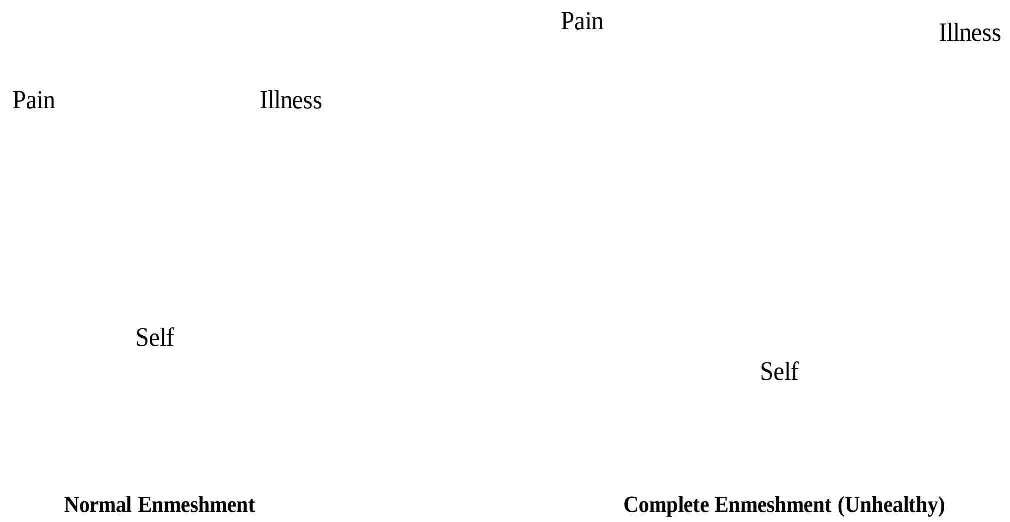

Figure 1. Enmeshment of Pain, Illness, and Self-schemas *(adapted from Pincus and Morley, 2001)*

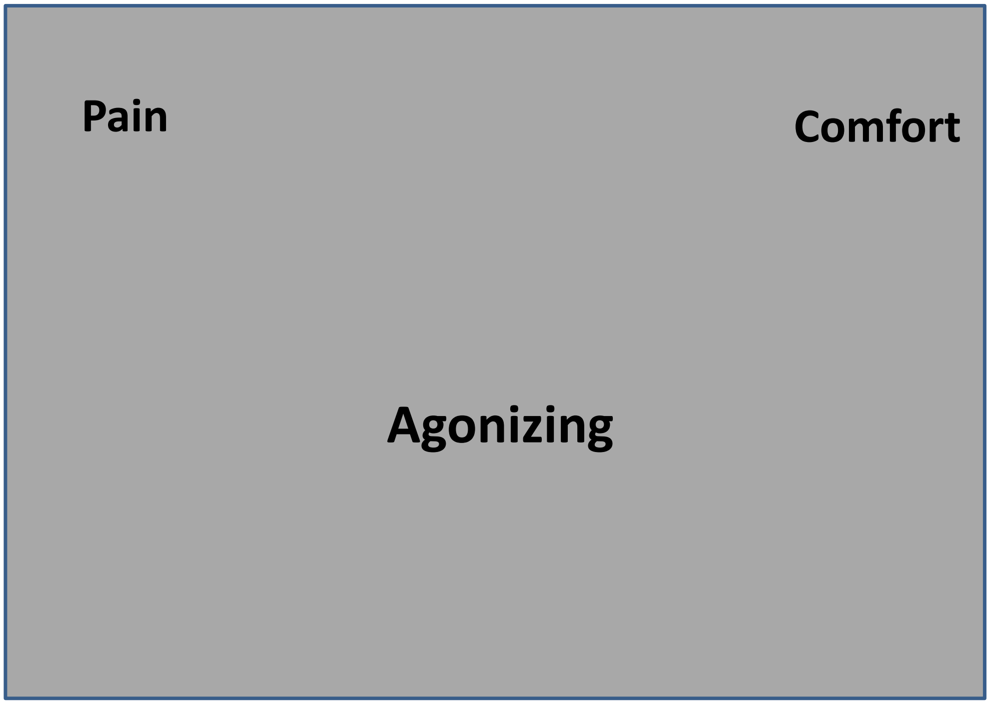

Figure 2. Sample IAT Screen

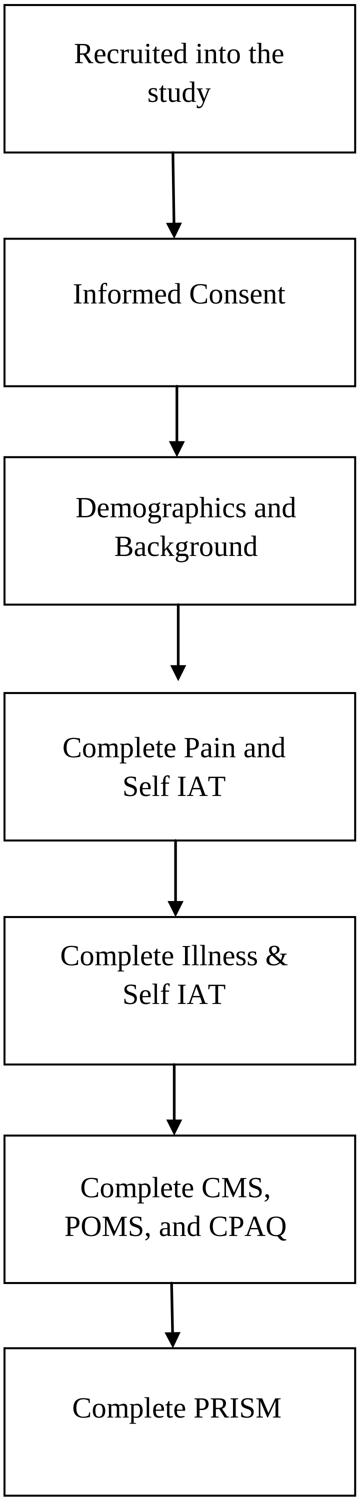

Figure 3. Schematic Diagram of Procedures

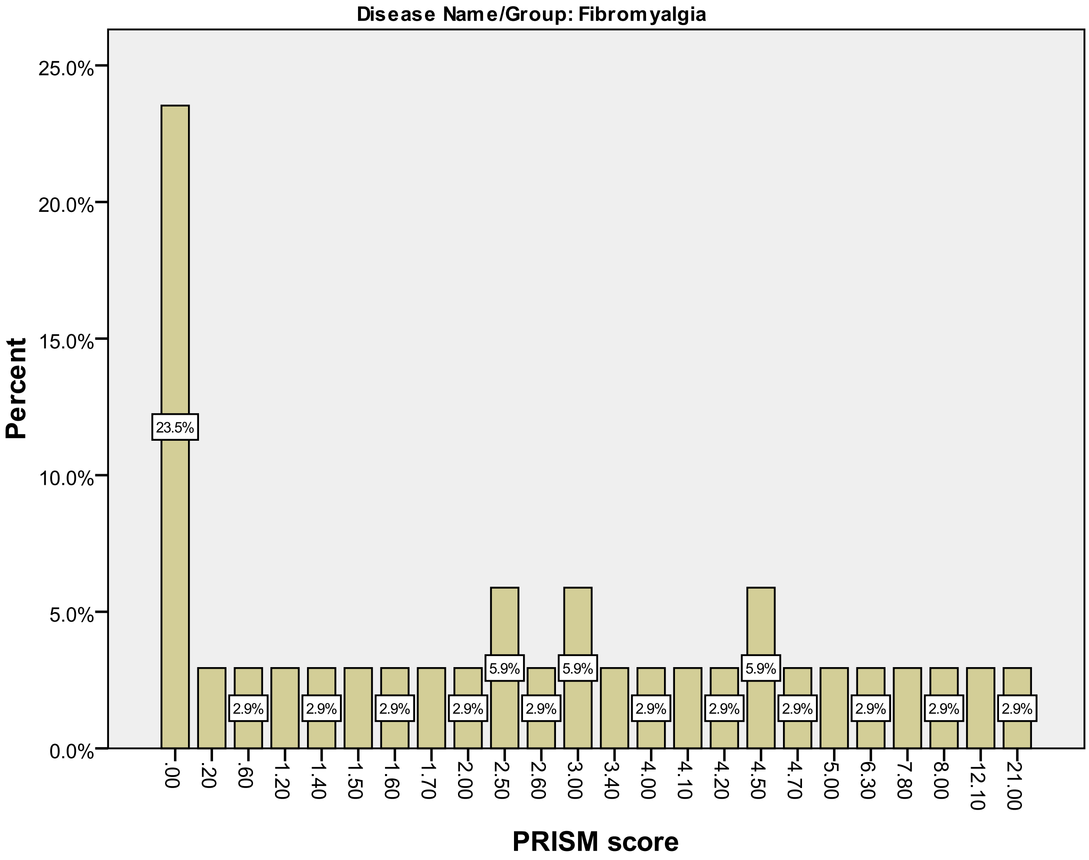

Figure 4. Frequency of Responses on the PRISM task in the FMS Sample

APPENDICES

Appendix A: The Constructed Meaning of Illness Scale (Fife, 1995)

DIRECTIONS: The items below ask how you see your life being affected by your illness. Circle the number that best describes how you have been feeling about your life during the ***past two weeks***.

	Strongly Agree	Agree	Disagree	Strongly Disagree
1. I feel my illness is something I will never recover from.	1	2	3	4
2. I feel my illness is serious, but I will be able to return to life as it was before.	1	2	3	4
3. I often feel I am an outsider because of my illness.	1	2	3	4
4. I feel that my illness is changing my life permanently so it will never be as good again.	1	2	3	4
5. I do not have the same chance as others for a satisfying life due to my illness.	1	2	3	4
6. I feel victimized by my illness.	1	2	3	4
7. I feel I am making a complete recovery from my illness.	1	2	3	4
8. The uncertainty of my illness is causing me great difficulty.	1	2	3	4
9. I feel my relationships with others have not been negatively affected by my illness.	1	2	3	4
10. I feel my illness has permanently interfered with achieving the most important goals I have set for myself.	1	2	3	4
11. My illness has a negative effect on the things I value most about myself.	1	2	3	4

Appendix B: Scripted Standard Instructions for the PRISM (Buchi & Sensky, 1999)

We would like to understand better how your illness [mention the illness] affects your life at the moment. I'd like you to imagine that this white board represents your life as it is now.

The yellow disk in the bottom right corner represents your "self," and this red disk represents your illness.

Where would you put your illness—the red disk—in your life at the moment? [Hand red disk to patient]

Most people have an intuitive idea of where to place the illness disk, but if someone does not appear to understand the above instructions, go to those below:

As this may be a rather unusual way of showing the place of your illness in your life, let me give you another example. The blue disk represents your work or your job. For some people, work is an essential part of their lives and makes all the difference in how they see themselves. Such a person would put the "Work" disk on top of the "Self" disk [demonstrate this]. For other people, work is not that important. For example, they may work just to earn money. Such a person would place the "Work" disk quite far from the "Self" disk [demonstrate].

Where would you put your illness—the red disk—in your life at the moment ? [Hand red disk to patient]

Measure the distance between the centers of the two disks—the Self-Illness Separation (SIS)

Appendix C :Attribute Categories and Stimulus Words used in the IATs (adapted from Grumm et al, 2008)

Pain IAT

Pain: agonizing, tender, aching, sore

Comforting/Free of Pain: easy, pain-free, painless, comfortable

Illness IAT

Illness: sick, unwell, disease, infirmity

Health: wellness, energy, strong, healthful

Appendix D: Profile of Mood States- Short Form

DIRECTIONS: Below is a list of words that describes feelings people have. Please read each one carefully. Rate each one according to HOW YOU HAVE BEEN FEELING DURING THE PAST WEEK INCLUDING TODAY.

0 = Not at all
1 = A little
2 = Moderately
3 = Quite a bit
4 = Extremely

1) Tense
2) Angry
3) Wornout
4) Lively
5) Confused
6) Shaky
7) Sad
8) Active
9) Grouchy
10) Energetic
11) Unworthy
12) Uneasy
13) Fatigued
14) Annoyed
15) Discouraged
16) Nervous
17) Lonely
18) Muddled
19) Exhausted
20) Anxious
21) Gloomy
22) Sluggish
23) Weary
24) Bewildered
25) Furious
26) Efficient
27) Full of pep
28) Bad-tempered
29) Forgetful
30) Vigorous

Appendix E: Chronic Pain Acceptance Questionnaire

Directions: below you will find a list of statements. Please rate the truth of each statement as it applies to you. Use the following rating scale to make your choices. For instance, if you believe a statement is ‘Always True,’ you would write a 6 in the blank next to that statement

---

0	1	2	3	4	5	6
Never True	Very rarely true	Seldom true	Sometimes true	Often true	Almost always true	Always true

1. I am getting on with the business of living no matter what my level of pain is ………
2. My life is going well, even though I have chronic pain………
3. It’s OK to experience pain ………
4. I would gladly sacrifice important things in my life to control this pain better ………
5. It’s not necessary for me to control my pain in order to handle my life well ………
6. Although things have changed, I am living a normal life despite my chronic pain
7. I need to concentrate on getting rid of my pain ………
8. There are many activities I do when I feel pain ………
9. I lead a full life even though I have chronic pain………
10. Controlling pain is less important than any other goals in my life ………
11. My thoughts and feelings about pain must change before I can take important steps in my life
12. Despite the pain, I am now sticking to a certain course in my life ………
13. Keeping my pain level under control takes first priority whenever I’m doing something
14. Before I can make any serious plans, I have to get some control over my pain ………
15. When my pain increases, I can still take care of my responsibilities ………
16. I will have better control over my life if I can control my negative thoughts about pain
17. I avoid putting myself in situations where my pain might increase ………
18. My worries and fears about what pain will do to me are true ………
19. It’s a relief to realize that I don’t have to change my pain to get on with my life
20. I have to struggle to do things when I have pain………

Scoring:
Activities engagement: Sum items 1, 2, 3, 5, 6, 8, 9, 10,12, 15, 19.
Pain willingness: reverse score items 4, 7, 11, 13, 14, 16,17, 18, 20 and sum.
Total: activity engagement þ pain willingness.