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FOSTERING POSITIVE EMOTION THROUGH SELF-COMPASSION IN
INDIVIDUALS
WITH CHRONIC PAIN

By
Melissa E. Ellsworth
B.A., University of Maryland, 2008
M.A., University of Louisville, 2016

A Dissertation
Submitted to the Faculty of the
College of Arts and Sciences of the University of Louisville
In Partial Fulfillment of the Requirements
For the Degree of

Doctor of Philosophy
in Clinical Psychology

Department of Psychological and Brain Sciences
University of Louisville
Louisville, Kentucky

August 2018

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DEDICATION

I would like to dedicate this dissertation to my best friend and colleague, Ghazel Tellawi. Without her, none of this would have been possible. No matter how far away, her support and love is felt in everything I do.

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First, I wish to thank my research mentor, Dr. Richard Lewine, who has provided invaluable guidance and support with this dissertation project, my clinical training and overall personal growth. I am also very grateful to the other members of my committee for their support and guidance throughout this process. This dissertation would not have been possible without the efforts of my two research assistants, Sara Bewley and Megan Ainsworth, and on-site nurse coordinator, Teresa Morgan. I am also grateful for all the other staff members at the University of Louisville Pain Management Center, including Dr. Aurel Neamtu and nursing staff, Bonnie, Denise and Julie, for their unwavering support throughout my time as a practicum student and development and completion of this research project. I would also like to thank those with whom I worked during my clinical internship at the Salt Lake City VA Healthcare System, who supported and encouraged me as I completed my writing. I also wish to thank two of my dear friends, Marcus Leppanen and Chelsea Coakley, for always believing in me and providing laughter, kind words and open ears that got me through many challenging times. I wish to also acknowledge all my fellow colleagues and other faculty members in the clinical psychology program for their support throughout my time in graduate school.

ABSTRACT

FOSTERING POSITIVE EMOTION THROUGH SELF-COMPASSION IN
INDIVIDUALS WITH CHRONIC PAIN

Melissa E. Ellsworth

August 7, 2018

Previous research in chronic pain has established that reducing or removing negative aspects of functioning, such as negative emotion, maladaptive thoughts and behaviors are associated with better outcomes in this population. More limited is the research on the role of positive aspects of functioning in those with chronic pain, specifically exploring the benefits of positive emotion and how this can be bolstered in individuals with chronic pain. Limited research to date has explored strategies to promote positive aspects of functioning, including savoring, gratitude, and mindfulness, but even more limited is research exploring the role of self-compassion as a resource for promoting positive emotion in those with chronic pain. This study had three main aims and an exploratory aim. In Aim 1, the basic relationships between self-compassion, positive and negative emotion, pain and functional variables were examined in order to establish criterion validity for their measures in a unique and diverse pain sample; Aim 2 addressed the need for an alternative measure of positive emotion that better aligns with self-compassion; and Aim 3 explored the unique role that self-compassion has in relation to positive emotion and adaptive functioning in individuals with chronic pain when compared to other important resilience factors, mindfulness and acceptance. In an

exploratory aim, this study also explored the potential role for self-compassion to moderate the relationship between pain severity and affect, as well as disability and quality of life.

84 patients with chronic pain at the Pain Management Center were recruited during the time of their appointments to participate in the study. Participants filled out self-report measures assessing sociodemographic, pain and psychological characteristics; rates of positive and negative emotion over the last week; levels of pain severity; rates of self-compassion, pain acceptance and mindfulness; as well as pain disability and current physical and mental components of quality of life (QoL). Results demonstrated that higher self-compassion was associated with higher positive emotion, lower negative emotion, lower pain severity and disability, and higher QoL. Multiple regression analyses demonstrated that self-compassion was a significant and unique predictor of change in positive and negative emotion, pain disability and mental components of QoL, independent of contributions made by mindfulness, pain acceptance, and covariates (income, gender, and age). Further, moderation analyses indicated that self-compassion significantly moderated the relationship between pain severity and negative affect as well as physical components of QoL.

These results added to the burgeoning literature on the role of self-compassion as a unique resilience factor in promoting positive emotion in those with chronic pain independent of sociodemographic variables and other similar resilience factors, such as mindfulness and acceptance. While this study was cross-sectional in nature and thus inferences about causality are limited, it suggests enough evidence to pursue future research with experimental or longitudinal, interventional designs on the role of self-

compassion in promoting positive emotion as well as other elements of adaptive functioning in those with chronic pain.

TABLE OF CONTENTS

	PAGE
DEDICATION.....	iii
ACKNOWLEDGMENTS	iv
ABSTRACT	v
LIST OF TABLES	ix
INTRODUCTION.....	1
METHODS	
Participants.....	48
Inclusion/Exclusion Criteria.....	48
Measures.....	49
Procedure.....	55
Data Preparation and Statistical Analysis.....	57
RESULTS	
Sample Characteristics.....	67
Hypothesis Testing.....	71
DISCUSSION.....	89
REFERENCES.....	116
CURRICULUM VITAE.....	169

LIST OF TABLES

TABLE	PAGE
Table 1. Relevant studies demonstrating effects of positive emotion in individuals with chronic pain.....	131
Table 2. Self-report studies exploring self-compassion, positive emotion and relevant correlates.....	135
Table 3. Summary of relevant studies exploring self-compassion in samples with chronic pain.....	137
Table 4. Studies examining the role of self-compassion and positive emotion/affect in chronic pain.....	140
Table 5. Sociodemographic characteristics of the sample.....	142
Table 6. Sample sociodemographic characteristics compared to U.S. Census Bureau statistics from 2016 by county, state and country.....	145
Table 7. Pain characteristics of the sample.	146
Table 8. Psychological characteristics of the sample.	149
Table 9. Study variable characteristics of the sample.....	150
Table 10. Pearson bivariate correlations between positive and negative affect, pain severity and disability and quality of life.	151
Table 11. Pearson bivariate correlations between self-compassion, pain acceptance and mindfulness.....	152
Table 12. Pearson bivariate correlations between self-compassion, subscales and dependent variables.	153
Table 13. Pearson bivariate correlations between self-compassion, mindfulness, pain acceptance and subscales, and dependent variables.....	154
Table 14. Hierarchical Multiple Regression: self-compassion, mindfulness, pain acceptance and covariates (gender, annual combined household income)	

predicting positive affect.	155
Table 15a. Hierarchical Multiple Regression: self-compassion, mindfulness, pain acceptance and covariates (gender, annual combined household income)	
predicting negative affect.	156
Table 15b. Hierarchical Multiple Regression: self-compassion, mindfulness, pain acceptance and covariates (age, gender, annual combined household income)	
predicting negative affect.	157
Table 16. Hierarchical Multiple Regression: self-compassion, mindfulness, pain acceptance and covariates (gender, annual combined household income)	
predicting pain severity.	158
Table 17. Hierarchical Multiple Regression: self-compassion, mindfulness, pain acceptance and covariates (gender, annual combined household income)	
predicting pain disability.	159
Table 18a. Hierarchical Multiple Regression: self-compassion, mindfulness, pain acceptance and covariates (gender, annual combined household income)	
predicting mental component of quality of life.....	160
Table 18b. Hierarchical Multiple Regression: self-compassion, mindfulness, pain acceptance and covariates (gender, annual combined household income)	
predicting physical component of quality of life.	161
Table 19. Moderation analyses: average pain severity over the last week and positive affect as moderated by self-compassion, controlling for effects of annual household income.....	162
Table 20a. Moderation analyses: average pain severity over the last week and negative affect as moderated by self-compassion, controlling for effects of annual household income and age.....	163
Table 20b. Conditional effects of average pain severity on negative affect at low, average and high values self-compassion.....	164

Table 21. Moderation analyses: average pain severity over the last week and pain disability as moderated by self-compassion, controlling for effects of annual household income.	165
Table 22. Moderation analyses: average pain severity over the last week and the mental component of quality of life as moderated by self-compassion, controlling for effects of annual household income.	166
Table 23a. Moderation analyses: average pain severity over the last week and physical component of quality of life as moderated by self-compassion, controlling for effects of annual household income.	167
Table 23b. Conditional effects of average pain severity on the physical component of QoL at low, average and high values self-compassion.....	168

CHAPTER I

INTRODUCTION

Study Background, Purpose and Rationale

Pain is defined as “an unpleasant sensory and emotional experience associated with actual or potential damage, or described in terms of such damage” (Mersky & Bogduk, 1994). While a majority of acute pain often resolves quickly with or without treatment, in a minority of individuals, pain persists. Chronic pain is characterized as some type of persistent (e.g., low back pain) or recurrent (e.g., migraine) acute pain, the duration of which exceeds three months or is beyond the expected period of healing for the original injury (Loeser, 2001). Chronic pain arises from an initial injury such as spinal injury, disease, or can even result from no known etiological cause. Prevalence estimates of chronic pain in the U.S. range from 14.6% to 64% depending on the study criteria and methodology (Johannes, Le, Zhou, et al., 2010). Chronic pain is a multidimensional experience, involving numerous physiological, emotional, cognitive and behavioral dimensions that all serve to mediate and moderate the experience of chronic pain (Gatchel, Peng, Peters, et al., 2007). As a result of the gate control theory of pain, Melzack and Casey (1968) concluded that pain is experienced as three domains: sensory-discriminative, affective-motivational and cognitive-evaluative. The sensory-discriminative component of pain includes the perception of painful sensations (e.g.

burning, gnawing or aching), their duration and location of the pain (Melzack & Casey, 1968). The affective-motivational component of pain includes the feelings of unpleasantness associated with the experience of physical pain and motivation to escape such pain. Finally, the cognitive-evaluative component includes the cognitive evaluations and appraisals of the sensations and unpleasantness of the pain and decision-making around responding to the pain, such as distraction. Melzack and Casey (1968) proposed that these different domains can minimize or strengthen each other, and individual differences such as personality factors or pre-existing mental health conditions, as well as situational factors such as controllability or predictability of pain, could influence the affective-motivational and cognitive-evaluative domains. As a result of this multidimensional experience, chronic pain can impact every aspect of the individual's life, including impaired emotional functioning such as depression or anxiety, impairment in daily functional activities such as sleep and job performance, social consequences such as relationship difficulties or isolation, and socioeconomic costs such as lost productivity or disability (Turk, Wilson & Cahana, 2011).

Ample studies have demonstrated the key role of negative emotion, or negative affect (NA), in chronic pain and its debilitating effects on pain and non-pain related outcomes, including higher pain severity (Burns, 2006) and pain-related disability (Boersma & Linton, 2006), poor sleep quality (O'Brien et al., 2010), pain catastrophizing and other cognitive processing biases (Pincus & Morley, 2011; Wong et al., 2015), poor self-regulation (Hamilton, Karoly, & Kitzman, 2004), greater use of narcotic pain medications (Martel, Dolman, Edwards, et al., 2014) and interpersonal difficulties (Sturgeon, Zautra & Arewasikporn, 2014). Given these apparent aversive consequences

of chronic pain, current widely accepted interventions focus on reducing, removing or controlling the negative emotions, cognitions, and behaviors associated with pain (e.g. Cognitive-Behavioral Therapy; Gatchel et al., 2007). However, focusing on negative emotion and other negative aspects of the chronic pain experience only illustrate part of the picture in understanding how to improve functioning in those with chronic pain.

Recent research has been growing to suggest that rather than focusing exclusively on reducing, controlling or removing negative emotion and other negative aspects in individuals with chronic pain, a shift towards increasing positive aspects of individual functioning potentially holds significant promise in improving the lives of these individuals. Specifically, there is emerging evidence that fostering positive emotion, or positive affect, in individuals with chronic pain promotes essential benefits and can alter their experience of chronic pain. Some studies even suggest that increasing positive affect variables may be more powerful predictors of health outcomes than negative affect variables (Fredrickson & Branigan, 2005), illustrating the importance of addressing positive aspects of functioning in individuals with chronic pain.

A number of studies, including experimental and clinical studies, have illustrated the potential benefits of positive affect in promoting adaptive psychological functioning that can ameliorate the pain experience itself, including intensity or disability from pain, or promote adaptive psychological well-being despite the presence of pain, including improved mood, cognition, interpersonal functioning or coping skills. For example, using a mood induction task, induced happy mood resulted in significantly lower pain ratings at rest and greater pain tolerance (Tang et al., 2008). Positive affect has also been shown to be associated with less pain severity and more pain tolerance (Pressman & Cohen, 2005).

Positive affect also has the potential to prevent an increase in pain when negative affect is high (Finan, Quartana & Smith, 2013) or prevent negative affect increases when pain is high (Strand, Zautra, Thoresen, 2006), suggesting a buffering effect of positive emotion (Fredrickson, Mancuso, Branigan, & Tugade, 2000). However, positive affect is also associated with other important outcomes related to improved functioning in chronic pain, such as reduced pain catastrophizing (Ong, Zautra & Reid, 2010) and increased self-regulatory health behavior (Hamilton, Karoly, & Kitzman, 2004).

Given these findings, exploring effective tools with which positive emotion or affect can be cultivated and accessed would seem critical for promoting improvements in functional outcomes related to pain, such as severity, disability and quality of life.

Intervention research has widely demonstrated that mindfulness and acceptance-based interventions have components that enhance positive emotion as well as improve pain and other critical health outcomes in individuals with chronic pain, but little is known about the specific components responsible for these changes. A relatively new concept in the empirical literature, and proposed component of these interventions, is self-compassion, which suggests a healthy, positive way of relating to oneself that could provide a means with which positive emotion could be cultivated. Self-compassion involves being “touched by and open to one’s own suffering, not avoiding or disconnecting from it, generating the desire to alleviate one’s suffering and to heal oneself with kindness” (Neff, 2003a, p. 87). Self-compassion also involves a non-judgmental stance towards one’s pain, inadequacies or failures and seeing these experiences as shared with human experience (Neff, 2003a). Self-compassion has been found to be associated with lower pain catastrophizing and pain disability in individuals

with chronic pain (Wren, Somers, Wright, et al., 2012). Further, self-compassion has been associated with adaptive coping styles in the face of chronic illness (Sirois, Molnar & Hirsch, 2015) and increased health-promoting behaviors, including improved eating habits, sleep behaviors, exercise and stress management (Sirois et al., 2015).

Self-compassion has also been found to be associated with higher positive emotion and other related positive variables, such as optimism and well-being, during experiences of adversity (Neff, Rude, & Kirkpatrick, 2007; Neely, Schallert, Mohammed, et al., 2009). Given these findings, it would be reasonable to suggest that self-compassion may be an important factor in promoting positive, adaptive functioning in individuals with chronic pain. Given the importance of positive emotion in improving functioning in those with chronic pain and the associations between self-compassion and positive emotion, it is possible that self-compassion can buffer against the deleterious effects of chronic pain by regulating emotion and improving functional outcomes.

This study addressed three main aims. First, it established the basic associations between self-compassion, positive and negative emotion/affect, pain severity and functional variables (pain disability and quality of life). Second, it explored alternative measurements of positive emotion/affect in relation to self-compassion. Third, given that self-compassion is a potential component of mindfulness and acceptance-based interventions, this study tested the relative contributions of self-compassion, acceptance and mindfulness in relation to positive and negative emotion/affect as well as pain severity, disability and quality of life (QoL). Last, in an exploratory aim, this study examined whether self-compassion could buffer against the deleterious effects of pain severity on emotion and functional variables, determining whether self-compassion is

associated with improved regulation of positive and negative emotion/affect in those with pain and better functional outcomes, including reduced pain disability and improved quality of life.

Foundational Aspects of Emotion

Although the focus of this study will primarily be on positive emotion, it is important to discuss positive emotion's relationship to negative emotion theoretically and empirically in order to understand the evidence supporting the importance of positive emotion in chronic pain. There are different definitions and conceptualizations of what constitutes a positive or negative emotion. Negative emotion include feelings such as 'hostile,' 'upset,' 'ashamed,' 'nervous,' or 'sad' (Levenson & Gottman, 1983; Watson, Clark & Tellegen, 1994). Positive emotion, on the other hand, "reflects one's level of pleasurable engagement with the environment," (Clark, Watson, & Leeka, 1989) and include feelings such as 'enthusiasm,' 'proud,' or 'excited' (Watson, Clark & Tellegen, 1988) or 'awe,' 'contentment,' 'calmness,' or 'joy' (Fredrickson, Tugade, Waugh, & Larkin, 2003). Both positive and negative emotions can be transient, brief and state-like experiences or more persistent, stable and trait-based experiences. Although some research uses terminology such as 'emotion,' 'affect,' or 'mood,' to differentiate duration, these distinctions are inconsistent and thus are often used interchangeably in the literature (Pressman & Cohen, 2005) as well as throughout this discussion.

Positive and negative emotion, either state or trait, are usually measured in research studies with the use of self-report questionnaires, most commonly using the Positive and Negative Affect Schedule (PANAS; Watson, Clark & Tellegen, 1988), a 20-item instrument that equally assesses positive and negative state affect as independent

dimensions or its extended, 60-item version the PANAS-X (Watson & Clark, 1994).

Alternatively, studies also measure positive and negative emotion experimentally through the use of mood induction, such as watching humorous films or playing positive music, or alternatively, films or music that induce negative emotions, in order to assess for state-like experiences (Pressman & Cohen, 2005).

Positive and negative emotion are two constructs that are theoretically independent, but whose measured correlation could vary from fully independent ($r=0$) to inversely related ($r=-1$) (Lumley, Cohen, Borszcz, et al., 2011). Some research studies suggest that this relationship can be influenced by specific conditions where positive and negative emotion may become more interdependent versus independent, such as when experiencing a chronic stressor such as chronic pain (Reich, Zautra & Davis, 2003). This has widespread implications for chronic pain research, in that if they are part of the same spectrum, the presence of negative emotion may prevent the experience of positive emotion, or inversely, the alleged benefits of positive emotion may just be a result of the absence of negative emotion. However, in conditions where they are mutually independent, positive emotion could provide benefits regardless of level of negative emotion. Thus, it is critical to understand the conditions with which positive emotions can be generated and provide benefit in those with chronic pain.

Theories of Emotion in Chronic Pain

The gate control theory of pain was the first developed to help explain how emotions and cognition can influence pain perception, creating a major shift in our previous understanding of chronic pain as a purely sensory experience and instead illustrating that pain is a multidimensional experience (Melzack & Wall, 1967).

Etiologically, it is based in part on the notion that individuals have evolved to have emotion neurobiologically linked with pain perception as part of a larger motivational network that aids in survival (Rhudy & Meagher, 2001). The theory describes how pain signals need to encounter particular neurological “gates” at the level of the spinal cord dorsal horn that determine the flow of nociceptive signals to the brain. Positive or negative emotions perceived in the brain can reduce or amplify, respectively, the transmission of pain signals through these spinal gates. Specifically, negative emotions can increase pain by altering descending pathways from the brain and opening neurological gates at the spinal cord, increasing pain perception. Inversely, positive emotions can reduce pain through the same pathways by closing these neurological gates, reducing or ceasing the perception of pain (Melzack, 1999). This theory has been supported and expanded in numerous empirical studies elucidating the effects of emotion in modulating pain (e.g. Keefe, Lumley, Anderson, et al., 2001; Greenwood, Thurston, Rumble, et al., 2003; Wiech & Tracey, 2009).

Although not developed specifically for chronic pain, one of the most prominent theories in understanding the role of positive emotion in modulating psychological and physiological functioning is the broaden-and-build theory of positive emotion (Fredrickson, 2001). This theory proposes that the cultivation of positive emotions such as joy, awe, inspiration, gratitude, pride and hope, offer an evolutionary, adaptive advantage in promoting human flourishing and survival (Fredrickson, 2001). The *broaden hypothesis* proposes that negative emotions narrow an individual’s cognitive processes and behavioral action tendencies, and that positive emotions can reduce the cognitive narrowing associated with negative emotions by broadening attentional and

cognitive resources that are often restricted during times of chronic stress, such as chronic pain (Fredrickson & Branigan, 2005). Concurrently, the cognitive broadening induced by positive emotions may have an “undoing effect” on the deleterious physiological effects of negative emotions (Fredrickson et al., 2000). The broadening and undoing effects of positive emotion might together account for evidence of the salubrious effects that positive emotions have on psychological and physical health (Fredrickson et al., 2000; Fredrickson & Branigan, 2005). These effects may also help explain the benefits of positive emotion in chronic pain. Given that pain is a type of chronic stressor and the proposed “undoing effect” of positive emotion, positive emotion may buffer against deleterious physiological effects of negative emotion experienced in chronic pain patients, such as increased pain severity or co-morbid physical difficulties such as poor sleep quality or disability. Further, the broadening of positive emotion may be responsible for countering cognitively narrowing effects in individuals with chronic pain such as pain catastrophizing and other forms of maladaptive informational processing (Pincus & Morley, 2001), and broadening attention and cognition in ways that can adaptively increase access to better coping resources.

The *build hypothesis* of the theory suggests that although individual states of positive emotions are fleeting, the broadening of attentional resources that flow from these experiences can lead to the accumulation of personal resources, such as improved coping skills, health-promoting behaviors and social support that are long-lasting and can be used during times of stress, creating sustainable forms of positive functioning (Fredrickson, 2001). Ultimately, the cumulative building of enduring personal resources over time may foster resilience in the long-term, an important factor in the experience of

chronic pain. Sturgeon & Zautra (2010) defined the term “resilience” as the ability to maintain adaptive emotional, cognitive and behavioral functioning despite illness, or in this case, chronic pain. Resilient individuals are more easily able to recover from stress, sustain engagement in valued living activities and experience growth in different domains as a result of chronic pain, such as finding meaning in chronic pain or lowering reactivity to the chronic pain experience (Sturgeon & Zautra, 2010).

While the broaden-and-build theory suggests that positive emotions may buffer against the deleterious effects of negative emotion and stress, other theories and research studies suggest that experiencing a stressor such as chronic pain may make it more difficult to experience positive emotion. One such theory, the dynamic model of affect (Zautra, Smith, Affleck & Tennen, 2001), suggests that under periods of low stress, individuals can engage in more complex information processing and are more capable of experiencing a full range of both positive and negative emotions. Thus, under periods of low stress, positive and negative emotions are more or less unrelated and exist independently of one another. However, during times of high or chronic stress, such as chronic pain, attentional resources become concentrated on the stressor, increase perception of threat, and reduce the capacity to discriminate variable informational resources. During these times, negative emotions “overshadow” positive emotions, making it more difficult to access and differentiate positive emotions from negative emotions (Zautra et al., 2001). Thus, negative and positive emotion become highly inversely correlated along a unidimensional spectrum. Additionally, a relative deficit in positive emotion even during times of low stress would further increase vulnerability to negative emotion during stressful periods. This model may help explain some of the

difficulty which individuals with chronic pain have in accessing positive emotion and suggests the importance of acquiring strategies in which positive emotion can be shunted to the forefront to weaken the coupling of negative emotion and chronic pain, whereby the dominant effects of negative emotion can be dampened and positive emotion can thrive.

Benefits of Positive Emotion in Chronic Pain

Empirical evidence suggests the importance of positive emotion in chronic pain and offers support for the previously discussed theories. Positive emotions, in general, have been found to be analgesic. Neurobiologically, neural substrates that underlie the reward system in the brain share functions with pain reduction; activation of dopaminergic neurons associated with reward and pleasure behaviors, such as sex or appetitive satiation, also promote analgesic effects (Franklin, 1998). Activation of these dopaminergic reward systems has been found to be correlated with analgesia during placebo treatment and more positive mood ratings, suggesting shared variance in positive emotion and pain reduction (Zubieta & Stohler, 2009). Also, participants experiencing pain analgesia when viewing pictures of romantic partners has been linked with reward circuitry activation of the brain (Younger, Aron, Parke, et al., 2010). Fields (2007) suggests that pain suppression is linked to positive emotion in part due to opioids acting on dopaminergic neurotransmission when engaging in reward-driven or pleasure-seeking behavior. Similarly, some research suggests positive emotions associated with prosocial behavior, such as social connection and love, may also be linked with pain analgesia. Eisenberger (2012) found that thinking about losing a loved one or inducing social rejection in a computer-based task activates the dorsal anterior cingulate cortex, a brain

region also responsible for sensory and affective experiences of physical pain. These findings suggest shared neurobiological pathways with the absence of positive, affiliative emotions can lead to increases in physical pain.

Self-reported pain has frequently been associated with state and trait positive affect in patients with chronic pain (see Table 1 for detailed findings from relevant studies). Higher reported trait positive affect has been associated with less pain in patients with fibromyalgia and rheumatoid arthritis (Potter, Zautra & Reich, 2000). Additionally, higher state positive affect has been found to be significantly associated with less pain in patients with sickle-cell disease (Gil, Carson, Porter, et al. 2004). Higher postoperative positive affect following spinal surgery in those with chronic back pain has also been found to be significantly associated with higher postoperative quality of life (Seebach, Kirkhart, Lating, et al. 2012). Prospective studies have also been conducted to explore the relationship between positive emotion and chronic pain and have been particularly useful in determining their interrelationships with negative emotion. Additionally, given empirical ambiguity with which positive and negative emotions relate to one another, prospective studies help shed light on their complex relationship in the context of chronic pain. Ong and colleagues (2010) used a daily diary assessment to explore the role of psychological resilience and positive emotions in relation to daily pain catastrophizing in men and women with non-malignant chronic pain. Results indicated a significant, negative correlation between daily positive emotions and pain intensity. Additionally, there was a significant relationship between positive emotion reported on one day and a reduction in pain catastrophizing on the subsequent day, with greater effects in women. Mediation analyses also revealed that positive emotion explained 44% of the variance in

the relationship between psychological resilience and daily pain catastrophizing. In relation to the broaden-and-build theory (Fredrickson, 2001), this study highlighted the important role that positive emotions can have in buffering against narrowed attentional cognitions that come with the experience of a chronic stressor like pain, although causation cannot be determined as the study design was cross-sectional. These findings highlight the potential role of positive emotion as a major factor in promoting resilience in chronic pain.

In another prospective study, Zautra, Smith, Affleck and colleagues (2001) demonstrated support of the dynamic model of affect, finding that high weekly positive affect predicted lower weekly negative affect even when pain was high, a finding replicated in other studies (Zautra et al., 2005; Strand et al., 2006). Zautra and colleagues (2005) also demonstrated that deficits in positive affect in a given week were related to higher negative affect, which predicted increased pain in subsequent weeks. They also found similar results for average positive affect, where they found that those with higher overall average positive affect were significantly less likely to have negative affect during high pain weeks, and higher average positive affect across the weekly reports was significantly associated with lower reports of pain. Combined, these findings also lend support to the broaden-and-build theory, demonstrating that positive affect could buffer against negative affect and potentially promote resilience even in the face of high pain. However, this study does not address how the participants were able to generate or sustain positive affect amidst experiencing chronic pain. Yet, if the ability to sustain positive affect can protect against increases in negative affect even during times of increased pain or stress, and negative affect is associated with greater pain and poor

functional outcomes, then adaptive strategies directed at increasing sustainable positive affect in those with chronic pain would seem highly beneficial.

However, some studies also suggest that there might be a difference in trait versus state levels of positive and negative affect in its relationship to the experience of chronic pain. Finan and colleagues (2013) explored the relationship between trait or “stable” positive and negative affect versus state-dependent positive and negative affect in relation to daily experience of pain in participants with chronic knee osteoarthritis pain. Results indicated that only stable negative affect was significantly associated with higher pain across diary days, while stable positive affect had no relationship. Neither stable positive nor negative affect had a significant relationship with experimentally induced pain. These findings are inconsistent with findings in Zautra and colleagues (2005) in relation to the significant association between average positive affect and clinical pain reports, but findings may have also differed because this study was examining otherwise healthy subjects experiencing experimentally induced pain instead of those with chronic pain. The opposite pattern was indicated with state negative and positive affect, specifically that when state levels of positive affect were high (positive affect elevated in relation to affective mean), pain was lower, and this effect remained when state negative affect was added as a covariate, suggesting that daily fluctuations in positive affect influence pain irrespective of negative affect. Similarly, the significant relationship between daily variations in negative affect and pain became insignificant when positive affect was added as a covariate. Overall, this study’s findings highlight many important points about the complex relationship between positive affect, negative affect, and pain as a function of variable temporal dynamics of measurement, specifically daily fluctuations in affect

versus trait-level affect (Finan et al., 2013). Past research has found that positive affect is generally more variable than negative affect and can buffer against daily pain when negative affect is high. This finding that state positive affect was more predictive of daily changes in pain is important as it suggests even short-term inductions of positive affect can have ameliorative effects on chronic pain. Further, the finding that positive affect dampened the relationship between state negative affect and daily pain to insignificant levels suggests the potential that daily practice of positive affect -enhancing strategies may dampen chronic pain sensitivity and deleterious effects of negative affect over time. Also, in line with broaden-and-build theory, short-term increases in positive affect can lead to acquiring personal resources that may promote more lasting change in how one copes with chronic pain.

Strategies for Promoting Positive Emotion

Overall, the preponderance of research suggests that positive emotions may become more critical to preservation of well-being during times of chronic pain and may promote sustainable sources of resilience over time. However, given the potential difficulties that many individuals with chronic pain may have in generating and experiencing positive emotional states, exploring and determining different strategies these individuals can use to amplify access and cultivation of these positive emotions needs to be addressed. Empirical studies in positive psychology have suggested a number of interventional strategies that have been linked with increasing positive emotion, including expressing gratitude, setting goals, cultivating hope, journaling about positive events, imagining the best possible self, and using personal strengths to enhance well-being (see Bolier, Haverman, Westerhof, et al., 2013 for a meta-analytic review).

Specifically, a number of studies have demonstrated the beneficial effects of some of these strategies for promoting positive emotion and other aspects of subjective well-being in individuals with chronic pain, such as expressive writing (Broderick, Junghaenel & Schwartz, 2005), optimism exercises (Hanssen, Peters, Vlaeyen, et al., 2013) and expressing gratitude (Ng & Wong, 2013). Furthermore, current empirically supported treatments for chronic pain, including Cognitive-Behavioral Therapy (CBT), Acceptance and Commitment Therapy (ACT) and Mindfulness-Based Stress Reduction (MBSR), may promote positive emotion via different strategies, such as cognitive reappraisal or scheduling pleasant activities (CBT), acceptance and pursuing value-driven goals (ACT) or engaging in awareness and relaxation training (MBSR). However, a potentially promising positive construct that has begun to receive more attention in this literature, self-compassion, may be another important strategy that individuals with chronic pain can use to access positive emotion.

Self-Compassion: Conceptualization

The construct of self-compassion has often been theoretically defined in scientific research based on its conceptualization in Buddhist literature (Kornfield, 1993; Hanh, 1997; Salzberg, 1997). Much of the empirical literature to date has been done on compassion and its close cousin, empathy, yet Buddhism teaches that self-compassion is just as important as compassion for others (Salzberg, 1997) and historically, compassion for the self and others are inextricably linked in Buddhism (Neff, 2003a). This led to the emergence of research that sought to distinguish the two conceptually and empirically in order to examine the unique elements of self-compassion. Self-compassion is derived from this overall concept of compassion, which is “being touched by the suffering of

others, opening one's awareness to others' pain and not avoiding or disconnecting from it, so that feelings of kindness toward others and the desire to alleviate their suffering as it emerges" (Wispe, 1991). Self-compassion turns compassion inwardly and directs it towards the self in a deliberate way.

The empirical study of self-compassion began with the development and validation of the Self-Compassion Scale (SCS; Neff, 2003b) which conceptualized self-compassion in the context of its Buddhist origins. Through creating this measure, Neff developed an operational definition of self-compassion, which was described as having three components: 1) self-kindness versus self-judgment; 2) common humanity versus isolation; and 3) mindfulness versus over-identification (Neff, 2003b). The first factor is defined by being kind and understanding of one's flaws and failures instead of judging and criticizing. The second factor is defined by seeing one's flaws and imperfections as part of a common human experience shared by others rather than feeling alone in one's experiences. The third factor is defined as holding one's painful emotions and feelings about the self with a balanced awareness rather than over-identifying with or ruminating on them. Each of the three domains describes two dichotomous components, where the former of each domain describes higher self-compassion (self-kindness, common humanity and mindfulness) and the latter describes lower overall self-compassion (self-judgment, isolation and over-identification).

Neff's definition of self-compassion proposed that these factors are distinct concepts, but that each factor contributes to the others in some capacity (Barnard & Curry, 2011). For example, a certain level of mindfulness may be required in order to create awareness and some distance from painful thoughts and experiences that gives

space for self-kindness and common humanity to arise. Inversely, having self-kindness and a sense of common humanity and the belief that others share in human suffering can make it easier to have mindfulness, or balanced awareness, of difficult experiences (Neff, 2003a). Another way is that with higher common humanity, the belief that suffering, failure or inadequacies is experienced by others can lessen the personal responsibility and judgment of one's own failures and inadequacies (Neff, 2003a). Given the theoretical relationships between the three domains, Neff argued that self-compassion would be the single overarching construct uniting the three domains together (Neff, 2003b).

Although the Buddhist-based conceptualization of self-compassion is the most researched given the widespread use of the Self-Compassion Scale (Neff, 2003b), it is not the only conceptualization of self-compassion. Researcher Paul Gilbert describes self-compassion as “a process of relating to oneself where one develops genuine concern for one's own wellbeing, sympathy and tolerance of one's own distress, empathy and non-judgmental attitudes, resulting in self-warmth or the action of self-reassurance” (Gilbert & Proctor, 2006, pp. 357). Gilbert's definition of self-compassion developed from literature on evolutionary and attachment theory (Gilbert, 2009) as opposed to Buddhism, and he details developmental processes that can promote or inhibit self-compassion. He argues that individuals have evolved to engender motives for affiliative and affectionate behavior, but that in some individuals, particularly those who experience early interpersonal abuse or neglect, motives for affiliative behavior are thwarted by heightened perceptions of threat and distrust with the social environment (Gilbert & Proctor, 2006). Additionally, he suggests these early experiences lead to dysfunctional attachment development coupled with a reduced ability to self-soothe and fears of self-

compassion, whereas in typically developing individuals, self-compassion would promote a sense of safety and buffer against feelings of threat (Gilbert & Proctor, 2006). While there are differences between Neff's and Gilbert's derivations of self-compassion, their conceptualizations of self-compassion are ultimately overlapping and include elements from the rich and long-standing literatures in Buddhism and attachment theory.

Self-Compassion and Relationship with Mindfulness and Acceptance

Theoretically, while self-compassion may integrate components of mindfulness and acceptance, it also differs from them in a number of ways (Neff & Dahm, 2015). While mindfulness and acceptance allow *experiences* to arise as they are without resistance, such as a painful “stabbing” one might feel during chronic pain, self-compassion orients toward and targets the *experiencer* that is suffering with a caring, concerning attitude and the motivation to soothe oneself (Germer, 2009). Further, unlike mindfulness and acceptance, which are used when observing all internal experiences, either good, bad or neutral, self-compassion and its component of mindfulness is narrower in scope, as it is utilized only in the context of negative thoughts, feelings, and other sources of suffering. For example, while mindfulness and acceptance can be utilized when examining all experiences in general, one would not need to extend self-compassion towards positive or neutral events, as compassion is an inherent antidote to experiences of suffering (Neff & Dahm, 2015). Further, self-compassion is thought to be a broader construct than mindfulness and acceptance by including the components of *self-kindness*, an active soothing of oneself during painful experiences, and *common humanity*, realizing that such experiences are a part of all human experiences. However, these components are not necessarily inherent to mindfulness and acceptance (Bishop et al., 2004). While one can be *mindfully* aware of painful experiences and *accept* the present moment without

resistance, good or bad, self-compassion goes an extra step to intentionally wish the experiencer be free of suffering and realizing that they are not alone in this experience (Neff & Dahm, 2015).

Interventions for Fostering Self-Compassion and Findings for Positive Emotion

As the construct of self-compassion has only recently begun to flourish in the empirical literature, few interventions have been developed with the intention of increasing or teaching self-compassion. Yet, these and other interventions are important to consider when determining ways in which self-compassion can be increased in patients with chronic pain, particularly in those who do not have high levels of self-compassion and may benefit from its effects. Some researchers argue that cultivating self-compassion explains much of the success from mindfulness-based interventions overall (Kuyken, Watkins, Holden, et al., 2010) and Germer (2009) suggested that a key aspect of promoting positive mental states associated with mindfulness-based interventions may be attributed to self-compassion. Additionally, success from mindfulness-based interventions in the treatment of depression and anxiety may be due to the way self-compassion is able to counteract the self-criticism and excessive self-control often found in those who struggle with these disorders (Germer, 2009). There are a number of interventions that have been studied more extensively with regard to promoting self-compassion, including Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1990); Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999); Mindful Self-Compassion (MSC; Neff & Germer, 2013); Compassion Focused Therapy (Gilbert, 2009), and Loving Kindness Meditation (LKM; Salzberg, 1995). Additionally, many studies using these interventions have explored their role in fostering positive emotion

with significant benefits (e.g. Kranz, Bollinger, & Nilges, 2010, Zeng, Chiu, Wang, Oei & Leung, 2015).

Mindfulness-Based Stress Reduction (MBSR; Kabat-Zinn, 1990) is an 8-week group-based program originally designed for applications in chronic pain and other populations with chronic disease to help manage stress using a series of mindfulness meditations, yoga movements and didactic trainings. Studies have also suggested MBSR participation can foster changes in positive emotion. Using electroencephalogram (EEG) testing in a sample of healthy meditating participants, Davidson and colleagues (2003) found significant increases in left-sided anterior activation, an area associated with increased positive emotion, following participation in MBSR. Some of the effects resulting from MBSR may be related to changes in self-compassion, as research using self-report measures has demonstrated that changes in mindfulness have been found to predict changes in self-compassion (Birnie, Speca, & Carlson, 2010).

Acceptance and Commitment Therapy (ACT; Hayes et al., 1999) has emerged as an empirically effective intervention for a number of psychological and physical conditions (Ruiz, 2010). ACT facilitates psychological flexibility through the use of six core processes: acceptance, contact with the present moment, cognitive defusion, self-as-context, values and committed action (Hayes et al., 1999). Further, research suggests that ACT processes may be at least implicitly self-compassionate, and that the hexaflex processes of ACT may overlap with Neff's conceptualization of self-compassion (Yadavaia, Hayes, & Vilardaga, 2014). However, despite consistencies with self-compassion and the processes and ACT, caution should be exerted when trying to fit the construct itself into the hexaflex model. These processes do not represent everything

involved in human well-being and psychological flexibility, and while self-compassion may be implicitly woven through ACT processes, a more explicit emphasis on self-compassion within ACT may allow for more robust changes in self-compassion and relevant outcomes. One study to date has tested the role of explicitly filtering a self-compassionate orientation within a brief, 6-hour ACT intervention using a healthy undergraduate sample (Yadavaia, Hayes & Vilardaga, 2014) demonstrating significant differences in self-compassion differences following treatment versus control condition ($p < .001$), with large effect sizes from pre to post treatment ($p < .0001$, $d = 1.15$) and pre to 2-month follow up ($p < .0001$, $d = 1.54$). This study raises the need to clarify relationship between ACT and self-compassion, such as the degree to which self-compassion is a process versus outcome variable, and to what extent self-compassion is responsible for changes across different psychological and physical outcomes. Finally, relevant findings have suggested that ACT increases positive emotion through promoting activity engagement and goal pursuits, improving overall happiness and well-being (Kranz, Bollinger, & Nilges, 2010). However, ACT is a multi-faceted intervention that may increase positive emotion in some individuals and not others. Further, some of its components may be more responsible than others for changes in positive emotion, and it is not clear to what extent self-compassion may be a unique mediator of these changes.

While self-compassion may be implicitly interwoven in MBSR and would fit within most ACT protocols, its relative emphasis may not be as heavily weighted as in more explicit compassion-focused interventions. The Mindful Self-Compassion (MSC; Neff & Germer, 2013) program is also an 8-week group-based program modeled after the structure of MBSR (2.5 hours weekly, and a half day meditation retreat) but developed to

explicitly increase self-compassion as a function of Neff's conceptualization of the construct (Neff & Germer, 2013). The program uses interpersonal exercises and guided meditations and has only been used in healthy populations to date, so generalizability to clinical samples such as chronic pain is unclear. Further, the MSC program is a relatively new intervention and thus relevant findings regarding its effects on positive emotion are also nascent. An RCT pilot study of the MSC program in 21 non-clinical participants found significant increases in levels of self-compassion as well as happiness post-intervention, suggesting the potential role that MSC has in increasing positive emotion. However, happiness is thought to be a composite of positive emotions, life satisfaction, and coping resources (Cohn, Fredrickson, Brown, Mikels & Conway, 2009), so follow-up research would need to determine whether positive emotions were specifically increased as a function of increased happiness.

Compassion Focused Therapy (CFT; Gilbert, 2009) is a cognitively-based therapy developed to help patients foster affiliative emotions such as warmth, caregiving and overall emotional responsiveness toward themselves during therapy. Further, this intervention is the only compassion-focused intervention thus far developed for clinical populations, including those who suffer from major depression, eating and bipolar disorders, traumatic histories and other individuals who experience high rates of shame, self-criticism and self-attacking (Gilbert & Proctor, 2006). The intervention includes exercises such as guided compassionate imagery exercises, increased use of self-kind language or "benevolent self-talk," and engaging in self-compassionate behaviors (Gilbert, 2009). Relevant findings indicate that in a 12-week pilot study of CFT in hospitalized day patients (n=6) with chronic mood disorders and traumatic histories,

patients experienced significant increases in self-compassion as well as significant reductions in self-attacking, shame, feelings of inferiority, depression and anxiety (Gilbert & Proctor, 2006). However, some drawbacks to these findings include no indication of whether self-compassion was measured empirically. Additionally, positive emotions have not been explicitly examined in this or other studies on CFT. However, these findings demonstrate CFT may still be a viable intervention for increasing self-compassion, particularly in those who may be resistant to feelings of self-warmth (Gilbert, 2009). This finding can be potentially promising for chronic pain patients as well, since a large number of chronic patients experience high levels of co-morbid clinical conditions that entail negative emotions such as depression (Bair, Robinson, Katon, & Kroenke, 2003) and traumatic histories (Lew, Tun & Cifu, 2009) that may further contribute to difficulties with experiencing positive emotions.

Another compassion-focused interventional strategy, Loving Kindness Meditation (LKM), is the most widely researched of the aforementioned interventions thought to increase self-compassion and compassion in general. LKM is a practice based in the Buddhist tradition used to develop love and other positive emotions while releasing negative emotions such as anger and sadness. It involves using silent mental phrases to direct feelings of love and kindness towards the self, a loved one, a neutral person, a person who has done you harm, and finally all people (Salzberg, 1995). Recent meta-analysis indicates LKM has overall shown medium effect sizes for increasing positive emotions in clinical and non-clinical samples (Hedges' $g = 0.424$; Zeng, Chiu, Wang, Oei & Leung, 2015), but individual study effect sizes range from small to large depending on individual participant factors and methodological rigor. Nonetheless, relevant findings

suggest that LKM may be a viable source for increasing positive emotions and broadening one's personal resources in support of the broaden-and-build theory of positive emotion. In a study by Fredrickson, Cohn, Coffey and colleagues (2008), participants engaged in a 6-week LKM intervention (n=102), completing baseline and post-intervention self-report measures assessing personal resources across cognitive, psychological and social domains, as well as daily self-report measures of positive and negative emotion using the Modified Differential Emotions Scale (Fredrickson et al., 2003). LKM was found to have significant effects on increasing daily positive emotions over time and increases in daily positive emotion were significantly associated with increased reports of personal resources, suggesting that positive emotion mediated the relationship between LKM and personal resources. These findings suggest that LKM is effective in enhancing positive emotions which are responsible for increases in personal resources across multiple life domains, supporting the broaden-and-build theory. This may be particularly relevant when considering interventions that could increase self-compassion in patients with chronic pain, as their effects may not only extend beyond increases in positive emotion, but also to the accumulation of multidimensional personal resources that serve as sources of resilience (Sturgeon & Zautra, 2010).

Neurobiological data has also been collected to suggest the effects of LKM on increasing positive emotion. Klimecki, Leiberg, Lamm and Singer (2013) scanned participants using functional magnetic resonance imaging (fMRI) before and after a one-day loving kindness meditation. After compassion training, participants reported higher positive emotion in response to video clips of people in distress, which also elicited activation in areas of the brain previously associated with love, affiliation, and position

such as reward and pleasure. This study is one of the first to demonstrate the neural changes that can occur even after a brief compassion-focused intervention, and changes to areas of the brain implicated for a number of positive emotions including love, affiliation, reward and pleasure, albeit short-term effects (Klimecki et al., 2013). This could have important implications for exploring neural plasticity in chronic pain patients and how compassion-based interventions function in this population at a neurobiological level, and whether brain changes in areas associated with positive emotions can be seen in these patients.

Only one study to date has actually empirically measured whether self-compassion is increased as a function of participating in LKM. Shahr and colleagues (2013) measured self-compassion using the Self-Compassion Scale (SCS; Neff, 2003b) and self-reported positive emotion after participating in a 7-week LKM intervention in individuals with high self-criticism, demonstrating significant increases in self-compassion and positive emotion after participation (effect sizes pre to post treatment were $d=1.11$, $p<.01$ and $d=.62$, $p<.05$, respectively). However, this study did not report correlations between self-compassion and positive emotion, so it is unclear as to what the relationship is between self-compassion and positive emotion. This and the other LKM studies illustrate the difficulty in determining if and how much self-compassion may have been responsible for some of the changes in positive emotion as a function of participating in LKM, considering that LKM is an intervention that not only focuses on increasing self-compassion for the self, but also increasing compassion for others. Some other drawbacks to these LKM studies include the lack of a treatment-control group, so causation cannot necessarily be determined between LKM and positive emotion. Further,

these studies on LKM were done with non-clinical participants so it is not clear whether the same effect would be found in participants with chronic pain.

There are also other less formal interventions studied that increase self-compassion. In an active treatment comparison of positive psychology interventions, an online self-compassion (n=327) and optimism writing exercise (n=322) were administered for 7 days to participants with varying levels of depression and compared to a control condition (n=353). The self-compassion intervention resulted in significant increases in happiness when compared to the control condition, observable at three ($t(180)=2.45, p=0.02$) and six months ($t(180)=3.20, p<0.001$) (Shapira & Mongrain, 2010). This study demonstrated the potential role that a brief self-compassion intervention can have in increasing rates of happiness, which partially includes positive emotions (Cohn et al., 2009), in a clinical population which may have more difficulty in accessing positive emotions, similarly to chronic pain patients. Also, these effects strengthened over time, suggesting the broaden-and-build theory of positive emotion and other positive aspects of functioning growing over time. This study also demonstrated effects in an online format, which could be beneficial for chronic pain patients with higher rates of disability or limited access to health care settings. Although this study was done in an internet-based non-clinical sample, given the high rates of depression in chronic pain patients, this finding supports the notion that certain patient subgroups with chronic pain may benefit more from self-compassion interventions over other intervention types and that assessing for individual moderators has important implications for determining for whom self-compassion-based interventions would work best.

Self-Compassion and Positive Emotion: Non-Interventional Studies

A number of studies have explicitly looked at self-compassion and its associations with positive emotion and its correlates (a more detailed review of these study findings can be found in Table 2). Self-compassion has been found to be significantly associated with positive emotion and its correlates of happiness and optimism, although several of these studies have been conducted in non-clinical undergraduate samples (Neff, Rude & Kirkpatrick, 2007; Neff & Vonk, 2009; Wei, Liao, Ku & Shaffer, 2011). Neff and Vonk (2009) found that self-compassion was significantly positively associated with positive emotion, happiness and optimism, even when self-esteem was controlled. Consistent findings were also found in a study of non-clinical participants that measured trait self-compassion and twice daily self-reports of positive affect using ecological momentary assessment (Krieger, Hermann, Zimmerman & Grosse Holtforth, 2015). Neff, Rude and Kirkpatrick (2007) found significant positive correlations between self-compassion and self-reported measures of happiness, optimism, positive affect, personal initiative, curiosity and exploration, variables that encompass a number of positive emotions as defined by the broaden-and-build theory as well as personal resources that are built by positive emotion (Fredrickson et al., 2008). Wei and colleagues (2011) found a significant positive relationship between self-compassion and subjective well-being, which included positive affect, happiness and life satisfaction; however, individual analyses were not presented on the specific relationships between self-compassion and positive emotion, thus specific conclusions cannot be drawn. Self-compassion may promote positive emotion in older individuals as well. Phillips and Ferguson (2013) found that in a sample of older participants aged 65 and over, self-report measure results indicated that higher self-compassion was found to be significantly positively correlated

with positive affect. This may be particularly useful considering that rates of chronic pain increase with age. Self-compassion has also been found to be associated with increased positive affect in individuals diagnosed with HIV (Brion, Leary, & Drabkin, 2013), suggesting self-compassion may be useful for promoting positive emotion in populations with chronic illnesses as well.

Given the relationship between mindfulness and self-compassion, mention of findings related to mindfulness and positive emotion are relevant. Empirical findings suggest a strong link between mindfulness and positive emotion, where mindfulness meditation has been shown to increase left-sided brain activation, which is consistent with increased positive affectivity (Davidson et al., 2003). One study in a non-meditator participant sample found that self-compassion was a significant partial mediator in the relationship between self-reported mindfulness and happiness, suggesting that self-compassion may be an active component of mindfulness by which positive emotions are fostered (Hollis-Walker & Colosimo, 2011).

However, some findings on self-compassion and positive emotion are mixed. One study failed to show that self-compassion fosters adaptability by enhancing positive emotions after exposure to a social stressor (Choi, Lee & Lee, 2014). This may be explained by the fact that the study was testing whether high self-compassion would lead to positive emotions when someone believes they performed better than someone else. Considering previous theoretical and empirical literature that self-compassion is associated with common humanity and more social connectedness, it would seem unlikely that high self-compassion would lead to positive emotion when comparing one's performance to another individual or benefiting from another's failure.

Self-Compassion and Chronic Pain

Self-compassion has been shown to have wide-reaching benefits for a number of clinical and non-clinical applications and has garnered a substantial amount of evidence in its role for promoting positive emotion and other positive aspects of adaptive psychological functioning. Unfortunately, its role in clinical populations with chronic physical disease and health conditions, specifically chronic pain, has received less attention to date (see Table 3 for more detailed findings about the studies discussed below on self-compassion and chronic pain). Sirois and colleagues (2015) found that self-compassion was significantly associated with greater use of adaptive coping styles, including active coping, positive reframing and acceptance, in individuals with irritable bowel syndrome and arthritis. In a pilot study exploring the effects of an 8-week Loving Kindness Meditation (LKM) intervention for individuals with chronic low back pain, Carson and colleagues (2015) found that LKM significantly reduced pain and psychological distress post-treatment and at 6-month follow-up, as well as reducing day-to-day anger and tension, and that greater LKM practice on a given day produced significantly lower pain at the end of practice that day, as well as improved levels of anger on the following day. Given the broaden-and-build theory of positive emotion and its “undoing effect” of negative emotion, it is possible that, although not measured explicitly, positive emotion was immediately increased as a result of LKM, leading to reductions in pain and negative affect. This has already been explicitly shown in Zautra and colleagues (2005) in fibromyalgia patients, where weekly increases in positive affect led to subsequent reductions in pain severity and negative affect in following weeks. Both study findings also lend support to the dynamic model of affect, where positive and

negative emotions are inversely correlated in the context of a chronic stressor like pain. Although positive emotion was not examined directly, the relationship between reduced pain in conjunction with reductions in anger suggest the potential role that compassion-focused interventions have in transforming negative emotions into positive ones, although future studies should include a measure of positive emotion to determine the temporal relationship between positive emotion, negative emotion, and pain reduction in relation to a compassion-focused intervention. While the treatment sample was small ($n=18$), a majority of the effect sizes were still significant, and the mean pre to post intervention effect sizes for pain outcomes were .42, and .51 for psychological factors, which were comparable effect sizes to traditional mindfulness meditation and CBT intervention studies. These findings suggest that LKM is potentially an equally viable and promising intervention for chronic pain as other more common, empirically supported interventions.

Another intervention study examined 27 individuals with chronic migraines and their response to a brief 20-minute LKM (Tonelli & Wachholtz, 2014). Participants reported a 33% reduction in pain intensity and 43% reduction in “emotional tension,” as a measure of negative affect. Although it is unclear what the items on the measure of emotional tension measured in terms of negative affect and whether any items addressed positive affect, emotional tension was significantly, positively correlated with pain intensity, suggesting that negative affect may predict pain intensity in these participants. This study also replicated Carson and colleagues’ (2005) findings on LKM for reducing pain intensity and negative emotions in a different pain sample, suggesting generalizability of LKM across diverse pain samples. Additionally, significant effects

were found even though the sample size for this study was small. This study also demonstrated significant effects even with a brief administration of LKM, suggesting the potential utility of LKM in chronic pain patients in a time-limited or low resource capacity. However, LKM is an intervention that is not exclusively focused on fostering self-compassion, and self-compassion was not specifically measured as an outcome in these studies, so it is unclear how much of the effects were uniquely attributed to self-compassion. Thus, dismantling studies would be needed to elucidate its unique variance in relation to outcomes. Despite this, both intervention studies show promise for the role of teaching self-compassion to chronic pain patients for increasing positive emotion or improving pain and psychological-related outcomes.

Mindfulness and acceptance-based interventions have also been studied extensively with respect to their effects on pain and non-related pain outcomes. A recent meta-analysis, which included nine RCTs and five clinical controlled studies exploring MBSR and ACT, found small to moderate effect sizes for these interventions on pain intensity (standard mean difference (SMD)=.37), depression (SMD=.32), anxiety (SMD=.40), physical well-being (SMD=.35) and quality of life (SMD=.41) (Veehof, Trompetter, Bohlmeijer & Schreurs, 2016). Further, these effect sizes have been found to be comparable to those found for CBT. While these effects are modest, little is known about the mechanisms of change that are responsible for these effects. Research has suggested that self-compassion may be a unique mechanism of change of acceptance and mindfulness-based interventions in individuals with chronic pain. In an intervention study using ACT in a sample of chronic pain participants, multi-level mediation analyses revealed that self-compassion was a unique and significant mediator of change in

psychosocial disability, depression, pain-related anxiety, number of medical visits and number of prescribed analgesics, and was the only significant mediator of change in non-physical disabilities (Vowles, Witkiewitz, Sowden & Ashworth, 2014). These findings suggest that potential benefits derived from ACT for individuals with chronic pain may be partially due to changes in self-compassion. Additionally, self-compassion was not explicitly emphasized in this intervention, suggesting that an increased focus on self-compassion may lead to even greater effect sizes in outcomes. These findings also show that while pain acceptance was also a mediator of change in outcomes, self-compassion accounted for variance in outcomes that were independent of pain acceptance, further suggesting that self-compassion accounts for unique effects in outcomes independent of acceptance.

Non-intervention studies have also explored self-compassion in the context of chronic pain. In a sample of 103 patients with rheumatoid arthritis (n=40) or unspecified, non-malignant chronic pain (n=63), Costa and Pinto-Gouveia (2011) examined the relationships between variations between two empirically distinct variables: self-reported *pain acceptance*, specifically, the 1) willingness to experience pain and 2) activity engagement) as measured by the Chronic Pain Acceptance Questionnaire (CPAQ); and self-compassion, as measured by the Self-Compassion Scale (SCS; Neff, 2003b), and how they relate to psychopathology (specifically, depression, anxiety, and stress). K-means cluster analyses were conducted to identify three patient subgroups: low, intermediate and high pain acceptance. One-way ANOVAs determined each group varied significantly across self-compassion and psychopathology scores. Specifically, the positive aspects of self-compassion (self-kindness, common humanity and mindfulness)

were significantly lower and negative aspects (self-judgment, isolation and over-identification) were significantly higher in the low pain acceptance group when compared to both intermediate and high pain acceptance. Although these findings are cross-sectional and associative in nature, they suggest a potential link between self-compassion and pain acceptance, another construct that has been proposed as important in promoting resilience in chronic pain patients (Sturgeon & Zautra, 2016), especially given the study's findings that the low pain acceptance group scored about four times higher in measures of anxiety, depression and stress than the intermediate pain group. While these constructs are similar, the moderate correlations between their measures ($r=.535$, $p<.05$ for CPAQ and SCS total scores) would suggest they are empirically distinct constructs that may enhance one another to improve outcomes in individuals with chronic pain.

In another study of the same 103 patients, there were significant negative correlations between self-compassion and depression, anxiety, and stress symptoms (Costa & Pinto-Gouveia, 2013). This study also found that those with lower self-compassion and higher experiential avoidance, characterized as attempts to avoid thoughts, feelings, memories, physical sensations, and other internal experiences, even if it causes long-term difficulties, were significantly associated with higher levels of stress. However, this study did not examine the relationship between self-compassion and experiential avoidance explicitly, such as whether self-compassion reduces experiential avoidance, a risk factor for poor outcomes in pain patients. It is also unclear as to what the unique effects of self-compassion were on outcomes in depression, anxiety and stress in relation to experiential avoidance.

Self-Compassion and Chronic Pain: Associations with Positive Emotion

A number of studies have proposed the beneficial role of positive emotion in patients with chronic pain, including its associations with improved pain-related and other important psychosocial outcomes. Given this evidence, determining strategies by which positive emotion can be fostered would seem critical in this population, and a number of studies have suggested that self-compassion may buffer against the deleterious effects of chronic pain on affect and promote other aspects of adaptive psychological functioning. However, only one study to date has empirically examined the associative relationships between self-compassion and positive emotion as well as other domains of functioning in a chronic pain sample (Wren et al., 2012). In a study of 88 obese patients with persistent musculoskeletal pain using self-report measures, correlational analyses revealed significant negative associations between self-compassion and negative affect, pain catastrophizing, and pain disability, and significant positive associations with positive affect and pain self-efficacy. Hierarchical linear regression analyses also showed that self-compassion was a significant independent predictor of both positive and negative affect, as well as pain self-efficacy, pain catastrophizing, and pain disability, even when demographic variables were controlled for (Wren et al., 2012). Self-compassion predicted 9% of the variance in pain catastrophizing and 5% of the variance in pain disability above and beyond demographic variables. Additionally, self-compassion significantly predicted 7% of the variance in positive affect and significantly predicted 15% of the variance in negative affect as measured by the PANAS (Watson et al., 1988). While the variance predicted was modest, these findings may be an underrepresentation of potentially greater significant effects had a more diverse positive emotion scale been used that included affiliative or love-based emotions. Although this

study is only cross-sectional in nature and causation cannot be determined, the finding that greater self-compassion is significantly associated with lower negative affect and higher positive affect, as well as significant associations with improved functioning such as pain disability, is consistent with both the dynamic model of affect (Zautra et al., 2001) and the broaden-and-build theory of positive emotion (Fredrickson, 2001) suggesting the need for particular strategies, like self-compassion, that can promote positive emotion and buffer against the effects of chronic stressors like pain on important pain and non-pain related functional variables.

Given the limited research on self-compassion and positive emotion in individuals with chronic pain, and the potential for self-compassion to enhance ACT processes, such as acceptance, study findings pertaining to variables included in ACT, such as pain acceptance, and positive emotion would seem relevant as an extension of this literature. In a study of individuals with osteoarthritis and fibromyalgia, Kratz, Davis and Zautra (2007) found that pain acceptance moderated the relationship with pain severity and negative affect, such that higher pain acceptance was associated with lower negative affect even when pain was high. While self-compassion is a distinct construct from pain acceptance, this evidence suggests the potential for the related but distinct construct of self-compassion to also serve as a unique buffer against pain's "coupling" effect with negative affect as suggested by the dynamic model of affect (Zautra et al., 2001).

In another study, Payne-Murphy and Beacham (2015) conducted an online study sampling participants with self-reported, non-malignant chronic pain. Self-report measures were administered in pain acceptance using the CPAQ, positive and negative affect using the PANAS and a self-reported perceived disability. Participants were split

into three groups: 1) high-high acceptance (high activity engagement (AE) and high pain willingness (PW); 2) high-low acceptance (high AE and low PW); and 3) low-low acceptance (low AE and low PW). Significant differences were found across all three groups; high-high acceptance group had the highest positive affect, lowest negative affect and least amount of perceived disability; low-low acceptance group had the lowest positive affect, highest negative affect, and highest perceived disability; and high-low group had moderate scores across measures. A similar study by Kranz, Bollinger and Nilges (2010) found that while both the pain willingness and activity engagement component of pain acceptance were significantly, positively correlated with positive affect, the relationship was fully mediated by activity engagement, which is consistent with findings related to behavioral activation and increase of positive mood (Sturmey, 2009). These results suggest a significant relationship between higher pain acceptance and positive emotion, similar to findings between self-compassion and positive emotion (Wren et al., 2012). However, despite these findings, the relationship between pain acceptance and self-compassion remains unclear. While self-compassion has a number of overlapping themes with the ACT hexaflex processes, pain acceptance, or acceptance broadly, is only one of the six of these processes and can be seen as a conceptually and empirically distinct variable from self-compassion. In fact, empirical evidence has suggested only moderate correlations between the SCS and CPAQ, $r=.54$, $p<.05$ for total scores, $r=.56$, $p<.05$ for total self-compassion and activity engagement, and an even smaller correlation, $r=.37$, $p<.05$, between total self-compassion and pain willingness subscale (Costa & Pinto-Gouveia, 2011). Similarly, in a sample of chronic pain participants, pain acceptance and self-compassion (measured by the CPAQ and SCS,

respectively) were significant but unique mediators responsible for changes in outcomes following ACT participation (Vowles et al., 2014), further suggesting their unique contributions to ACT's psychotherapeutic change. Thus, it's important to further delineate the similarities and distinctions between these constructs theoretically and empirically, but also determine how these unique variables are related to positive emotion in individuals with chronic pain.

Additionally, as mindfulness is a proposed facet of self-compassion empirically (Neff, 2003b), mention of the empirical findings on mindfulness and positive emotion in chronic pain would also seem relevant. Research on the dynamic model of affect (Zautra et al., 2001) has suggested that mindfulness is an important component in improving affective differentiation in patients with chronic pain so that positive emotions could be readily accessed and bolstered despite the presence of negative emotion. In a study of an online mindfulness intervention for fibromyalgia patients, those who underwent mindfulness training experienced increased levels of positive emotions and momentary positive affect associated with engaging in pleasant activities. These effects remained even when depression was controlled for, suggesting effects on positive emotion independent of reductions in these negative emotions (Davis & Zautra, 2013). However, other negative emotions, such as anxiety or anger, would need to be assessed in future studies to determine whether or not they would be controlled for as well. Mindfulness may also lend to more awareness and apparent access to positive emotions that can be used to build cognitive resources and resilience over time (Garland, Gaylord, & Fredrickson, 2011). However, similar to acceptance, the relationship between mindfulness and self-compassion in the literature is still ambiguous in some areas,

including measurement and their degree of overlap both theoretically and empirically. A study by Bowlin and Baer (2012) examining the role of mindfulness and self-compassion in relation to psychological well-being, found that mindfulness, as measured by the Five-Facet Mindfulness Questionnaire, was strongly correlated with the Self-Compassion Scale ($r=0.69$, $p<0.001$), yet tests of multicollinearity in this study were within the limits for problems with multicollinearity (variance inflation factors were below 2.0; Fox, 1991). Also, each variable predicted unique variance in well-being when the other was controlled for. Thus, it's important to take into consideration independent measures of mindfulness in relation to self-compassion to determine their shared and unique contributions to outcomes in positive emotion and chronic pain (for more detailed findings of these previously discussed studies, see Table 4.)

Self-Compassion and Adaptive Functioning

Self-compassion has also been found to be associated with adaptive health outcomes in non-chronic pain samples as well. Self-compassion has been found to be significantly associated with less sleep disturbances in young health professionals (Kemper, Mo & Khayat, 2015) and improved quality of life in those with mixed anxiety and depression (Van Dam, Sheppard, Forsyth, & Earleywine, 2011) and body image difficulties (Ferreira, Pinto-Gouveia and Duarte, 2013). Herriot, Wrosch, and Gouin (2018) found that higher levels of self-compassion was associated with lower daily cortisol levels in older adults who reported higher levels of physical health problems and functional disability; thus, self-compassion may be buffering against stress-related biological disturbances, which may have important implications in those with chronic pain as well.

Some studies have also found associations with self-compassion and improved health functioning through associations with positive and negative emotion. A meta-analytic study (Sirois, Kitner, & Kirsch, 2015) found that self-compassion was significantly positively associated with adaptive health-promoting behaviors (improved eating habits, exercise, sleep behaviors and stress management) through significant indirect effects on positive and negative emotion. This pattern of effects suggests that self-compassion may foster health-promoting behavior by downregulating the negative emotions that arise during health-related setbacks while at the same time increasing positive emotion that can lead to the cultivation of more healthful behaviors and other personal resources (Fredrickson, 2001). Similar to these findings, Terry, Leary, Mehta and Henderson (2013) conducted a multi-study exploration of the relationship between self-compassion, cognitive and emotional reactions to illness, and resulting health behaviors, finding that participants high in self-compassion experienced less negative affect (e.g. sad, weak, or embarrassed) when thinking about physical health problems. Although they did not look at the relationship with positive affect, they found a significant relationship between higher self-compassion and lower negative affect, where benevolent self-talk and motive for self-kindness were unique and significant mediators in the relationship. This suggests that self-compassion is associated with lower negative emotions about one's illness through increasing benevolent self-talk and motivation for self-kindness. Overall, these studies added evidence to support the notion that self-compassion may buffer against deleterious health outcomes through its association with downregulating negative affect and promoting positive affect, which can have important implications for adaptive functioning in those with chronic pain. However, these studies

did not examine these relationships in an actual sample with chronic pain, and it's important to determine if these results would be generalizable to these individuals.

Current Study: Overview

Only one study to date has examined the associations between self-compassion, positive and negative emotion/affect and functional variables (in a sample with musculoskeletal pain and comorbid obesity; Wren et al., 2012), thus the evidence for these relationships is quite limited both in terms of criterion validity for these measures and consistency and generalizability to other pain samples. This study explored the basic interrelationships between self-compassion, positive and negative emotion/affect, as well as functional outcomes related to disability and quality of life, to contribute to the criterion validity for these measures and their associations in a diverse pain sample (Aim 1). Establishing these basic relationships will strengthen the foundation for exploring these variables in future longitudinal, interventional and experimental studies in samples with chronic pain.

Second, a number of studies have found associations with self-compassion and positive emotion, yet some have found modest or non-significant associations. An issue in the research to date that may lead to these weaker associations between self-compassion and positive emotion may be related to the majority of studies using the Positive and Negative Affect Schedule (PANAS; Watson, Clark & Tellegen, 1988) to assess positive emotion. While the PANAS is a widely used and well-validated measure of emotion (Crawford & Henry, 2004), the positive affect subscale of the PANAS looks more at emotions associated with activation, pleasure and reward systems (e.g. items include 'enthusiastic', 'alert' and 'excited') as opposed to affiliative, soothing, or calming

positive emotions that may typically be more associated with a compassionate stance, as discussed in Gilbert's conceptualization of self-compassion (Gilbert, 2009). Thus, using the PANAS to assess positive emotion may be leading to results across studies that underrepresent the potentially significant effects that self-compassion may have in fostering positive emotion. These findings may suggest the need for assessing a more diverse range of positive emotions using alternative measures, such as the modified Differential Emotions Scale (Fredrickson et al., 2003) that may more accurately capture the positive emotions elicited from experiencing self-compassion. This study determined whether an alternative measure of emotions is more closely in line with the positive emotions captured by self-compassion and whether it may have more unique and stronger associations (Aim 2).

Third, there is a large body of evidence to support the importance of resilience factors in chronic pain, specifically mindfulness, acceptance and, more recently, self-compassion. Further, the importance of promoting positive emotion in those with chronic pain has been established as a critical component of adaptive functioning in those with chronic pain. A number of studies have demonstrated the associations between these resilience factors and the promotion of positive emotion, yet little research has compared their unique contributions to positive emotion and other variables of adaptive functioning within the same study. This study explored the unique relationships between these variables and propose that there is significant and unique variance that self-compassion contributes to positive and negative emotion, pain and other variables related to functioning, specifically pain disability and quality of life, when compared with mindfulness and acceptance (Aim 3).

Lastly, it has been established both theoretically and empirically in the literature that affect and pain severity are highly associated and can mutually influence each other. Specifically, given prominent theories of emotion and pain discussed earlier, a stressor such as chronic pain can have significant ramifications in terms of its restriction on the experience of positive emotion, amplification of negative emotion and deleterious effects on adaptive functioning such as disability and quality of life, which can then further exacerbate pain severity. In individuals with chronic pain, the response in the face of this stressor can significantly alter the cascade of deleterious effects on secondary reactions such as maladaptive emotions, cognitions and behaviors (Zautra, Johnson & Davis, 2005). Considering evidence for self-compassion being associated with promoting positive, adaptive functioning, it is possible that self-compassion could be associated with reduced deleterious effects in response to chronic pain, specifically with affect and other functional outcomes. Thus, this exploratory aim determined whether the association between pain severity and emotion (positive and negative), as well as the association between pain severity, pain disability and quality of life, will be moderated by self-compassion (Exploratory Aim).

Study Aims and Hypotheses

Aim 1. Explore the basic interrelationships between self-compassion, positive and negative emotion, as well as functional outcomes related to disability and quality of life, in a diverse pain sample, as well as establish criterion validity for the measures of these variables.

Only one study to date has explored the relationships between self-compassion, positive and negative emotion, and other functional outcomes in a diverse pain sample,

which suggested that higher self-compassion is associated with higher positive emotion, lower negative emotion and improved pain disability, as well as lower pain catastrophizing and better pain self-efficacy. However, evidence for these relationships in other pain samples, testing a broader measure of positive emotion other than the PANAS, as well as measuring other functional outcomes like quality of life, has not been established. Thus, further support was needed to establish these relationships in another diverse pain sample to increase generalizability, exploring a broader measure of positive emotion, and with other important domains of functioning like quality of life.

Hypothesis 1. Self-compassion will be significantly positively associated with positive emotion, and significantly negatively associated with negative emotion, pain severity, disability and quality of life.

Aim 2. Examine an alternative measure of positive emotion in chronic pain.

Given the current limitations in how many studies are measuring positive emotion, the need for assessing a more diverse range of positive emotions using alternative measures may more accurately capture the positive emotions elicited from experiencing self-compassion. The second aim determined whether a more diverse measure of positive emotion would have a unique and more strongly associated relationship with self-compassion than the PANAS.

Hypothesis 2. Using the modified Differential Emotions Scale (mDES), positive emotion will be more strongly positively associated with self-compassion than positive emotion as measured by the PANAS, and there will still be a significant relationship between the

mDES and Self-Compassion Scale even when affect as measured by the PANAS is controlled for.

Aim 3. Determine the associations and unique contributions from self-compassion, mindfulness, and acceptance on positive and negative emotion, pain severity, and functional variables.

This study explored the unique relationships between these variables and examine whether self-compassion contributes significant and unique variance in positive and negative emotion, pain and other variables of adaptive functioning, specifically pain disability and quality of life, when compared with mindfulness and acceptance.

Hypothesis 3a-b. Using multiple linear regression analyses, self-compassion would predict significantly unique variance in a) positive and b) negative emotion, independent of contributions from mindfulness and acceptance.

Hypothesis 4a-c. Using multiple linear regression analyses, self-compassion would predict significantly unique variance in a) pain severity, b) disability and c) quality of life, independent of contributions from mindfulness and acceptance.

Exploratory Aim. Determine whether self-compassion serves as a buffer against the deleterious effects of chronic pain on positive and negative emotion and functional variables.

Given prominent theories on the relationship between pain and emotion, such as the dynamic model of affect suggesting coupling of negative affect and pain when pain is high, this study tested whether the association between pain severity and emotion (positive and negative) will be moderated by self-compassion. Specifically, this

hypothesis predicted that there would be a statistically significant, negative relationship between pain severity and positive affect at low levels of self-compassion, that becomes less significant at average and then high levels of self-compassion, to illustrate the ability for self-compassion to attenuate the effects of pain severity on decreasing positive emotion, even when pain is high. Inversely, this hypothesis predicted that there will be a statistically significant, positive relationship between pain severity and negative affect at low levels of self-compassion, that becomes less significant at average and then high levels of self-compassion, to illustrate its attenuating effect on this relationship.

Hypothesis 5a-b. Using moderation analyses, the interaction between pain severity and self-compassion would predict unique and statistically significant variance in a) positive and b) negative affect. Specifically, self-compassion would moderate the relationship between pain severity and affect by a) attenuating pain severity's effect on decreasing positive affect; and b) attenuating pain severity's effect on increasing negative affect; even when pain severity is high.

Limited research to date has examined how self-compassion helps chronic pain patients sustain adaptive functioning in the face of experiencing pain, such as mitigating pain disability and improving quality of life. Given that chronic pain has been found to increase negative and decrease positive affect, which has significant ramifications on adaptive functioning in those with chronic pain, it would be important to address the role of self-compassion on these variables as well. Thus, this hypothesis will test whether the association between pain severity and disability and quality of life will be moderated by self-compassion.

This hypothesis predicts that there will be a statistically significant, positive relationship between pain severity and pain disability at low levels of self-compassion, that becomes less significant at average and then high levels of self-compassion, to illustrate its attenuating effect on this relationship. Inversely, it is predicted that at low levels of self-compassion, there will be a statistically significant negative relationship between mental and physical health quality of life that will become less significant at average and then high levels of self-compassion, to illustrate its attenuating effect on this relationship.

Hypothesis 6a-b. Using moderation analyses, the interaction between pain severity and self-compassion would predict unique and statistically significant variance in a) pain disability and b) quality of life. Specifically, self-compassion would moderate the relationship between pain severity and functional outcomes by a) attenuating pain severity's effect on increasing pain disability and b) attenuating pain severity's effect on decreasing quality of life; even when pain is high.

CHAPTER II

METHODS

Participants

Participants in this study included adults receiving assessment and treatment for chronic pain at the Pain Management Center, a multidisciplinary, interventional pain treatment program at University of Louisville hospital.

Inclusion/Exclusion Criteria

Specific inclusion criteria for participants were as follows: 1) Individuals 18 and over; 2) seeking treatment for chronic pain (present more days than not for the last three months or longer per the IASP classification for chronic pain); 3) have experienced some pain over the last week or would have without the aid of medication, analgesic/anesthetic procedure (e.g. steroid injection). Exclusion criteria consisted of: 1) patients with malignant pain or pain associated with HIV/AIDs, due to potential confounding variables associated with living with these conditions; 2) individuals with a current diagnosis of psychosis, schizophrenia or other psychotic disorder; and/or 3) cognitive disorder (e.g. dementia, delirium or amnesia), due to the potential, significant confounding effects that psychosis and cognitive-related disorders can have on positive and negative affect.

Measures

Sociodemographic Form

A sociodemographic form was administered to assess for gender, age, race and ethnicity, socioeconomic status/income level, education level, marital status, occupational status and disability status.

Psychological and Physical Health Form

In addition to these questions, participants were asked about current and previous medical, neurological and psychiatric diagnoses or conditions, and current medications used. Pain-specific questions were also asked, including primary location of pain, duration of pain, any pain-related diagnoses, and treatments tried for reducing pain.

Self-Compassion

The Self-Compassion Scale (SCS; Neff, 2003a) is a 26-item self-report measure that assesses for self-compassion across three dichotomous domains on a total of six subscales: 1) self-kindness versus self-judgment; 2) common humanity versus isolation; and 3) mindfulness versus over-identification (Neff, 2003b). Items are rated on a Likert scale ranging from 1 (almost never) to 5 (almost always). Negative items (self-judgment; isolation; and over-identification) are reverse coded and mean scores on the six subscales are averaged to produce an overall self-compassion score. Research on the factor structure of the SCS has indicated that the intercorrelations between the six domains can be explained by a single factor of self-compassion (Neff, 2016). The SCS has demonstrated good internal consistency in a chronic pain sample (Cronbach's $\alpha = .93$; Wren et al., 2012) as well as concurrent, convergent and discriminant validity in healthy populations (Neff, 2003). Given potential overlap between some subscales within

the SCS and measures of mindfulness and acceptance, the full-scale measure will be used in order to conduct more sophisticated statistical analyses to examine for multicollinearity issues between these measures. In this study's sample, the measure demonstrated good internal consistency (Cronbach's $\alpha = .86$). Subscales also demonstrated good internal consistency, including the Self-kindness subscale (Cronbach's $\alpha = .82$); Self-judgment subscale (Cronbach's $\alpha = .83$); Common Humanity (Cronbach's $\alpha = .70$); Isolation (Cronbach's $\alpha = .84$); Mindfulness (Cronbach's $\alpha = .74$); and Overidentification subscale (Cronbach's $\alpha = .77$).

Mindfulness

The Mindful Attention Awareness Scale (MAAS; Brown and Ryan, 2003) is a 15-item measure that assesses for dispositional or "trait" mindfulness, specifically the extent to which one is in a receptive state of awareness or attention to the present moment (e.g. "I find it difficult to stay focused on what's happening in the present moment.") Each item is rated on a scale from 1 (almost always) to 6 (almost never) and then scores are averaged to form the total score. The MAAS has been validated for use with college student and community adults (Brown & Ryan, 2003), and for individuals with cancer (Carlson & Brown, 2005). It has been shown to have good internal consistency reliability in chronic pain samples (Cronbach's $\alpha = .87$; McCracken, Gauntlett-Gilbert, & Vowles, 2007). In this study's sample, the measure demonstrated similarly good internal consistency (Cronbach's $\alpha = .83$).

Acceptance

Acceptance was assessed using the Chronic Pain Acceptance Questionnaire (CPAQ; McCracken, Vowles, Eccleston, 2004) a 20-item, self-report measure that

assesses pain acceptance along two domains: pain willingness (e.g. “It’s OK to experience pain”) and activity engagement (e.g. “when my pain increases, I still take care of my responsibilities”). Patients rate items on a scale from 0 (never true) to 5 (always true). Confirmatory factor analysis supports the validity of two-factor structure (Vowles, McCracken, McLeod, et al., 2008) and the two subscales and total scores from the CPAQ have been shown to be internally consistent (Cronbach’s $\alpha = .78-.82$; McCracken, Vowles, & Eccleston, 2004). In this study’s sample, the overall measure demonstrated somewhat poor internal consistency (Cronbach’s $\alpha = .53$); however, the subscale of Pain Willingness had fair internal consistency (Cronbach’s $\alpha = .78$) and the Activity Engagement subscale had good internal consistency (Cronbach’s $\alpha = .86$).

Positive and Negative Emotion

The Positive and Negative Affect Schedule (PANAS; Watson, Clark & Tellegen, 1988) is a 20-item, self-report measure that asks participants to rate the extent to which they feel specific positive and negative emotions either 1) right now; or 2) in the past week. In the current study, participants were asked to rate their emotions over the last week. Positive emotions items include “interested” or “excited,” while negative emotion items include “hostile” or “afraid.” Items are rated on a 5-point scale ranging from 1 (very slightly) to 5 (extremely). Subscales are produced for negative and positive emotion separately, which are calculated from the average of total negative and positive emotion scores, respectively. The measure has demonstrated good internal consistency in chronic pain samples (Cronbach’s $\alpha = .87$; Wren et al., 2012). In this study’s sample, the measure demonstrated good internal consistency (Cronbach’s $\alpha = .81$) for the entire measure, excellent internal consistency for the Positive Affect subscale (Cronbach’s

alpha = .92) and good internal consistency for the Negative Affect subscale (Cronbach's alpha = .89).

The modified Differential Emotions Scale (mDES; Frederickson et al., 2003) is a 20-item self-report measure based on the Differential Emotions Scale (Izard, 1977). The measure was modified to address the need for a wider range of positive emotions that were seen as not being captured by the mainly high-activation positive emotion states as measured by the PANAS (Watson, Wiese, Vaidya, & Tellegen, 1999). The measure asks the individual to indicate the greatest amount of negative emotions (e.g. "What is the most angry, irritated or annoyed you felt?) and positive emotions (e.g. "what is the most love, closeness or trust you've felt?") experienced either 1) over the last 24 hours or 2) over the past two weeks. In the current study, participants were asked to rate these emotions over the last week to ensure temporal consistency and thus more accurate comparison with the PANAS and pain severity measures. Participants rate responses on a 5-point scale of 0 (never) to 4 (most of the time). Positive and negative emotion items are totaled separately and averaged to produce a composite positive and negative emotion score, respectively. The subscale for positive emotions has a fair coefficient of reliability (Cronbach's alpha = .79). In this study's sample, the measure demonstrated similar internal consistency (Cronbach's alpha = .79), with the Positive Emotion and Negative Emotion subscale each demonstrating excellent internal consistency (Cronbach's alpha=.93).

Pain Severity

The Numerical Rating Scale (NRS) is an 11-point self-report measure assessing pain severity. Items are rated from 0 (no pain) to 10 (worst imaginable pain). Participants

rated their level of pain severity on four different numerical rating scales: current pain level, highest, worst and average pain level over the past week. Numerical rating scales have overall been shown to have significant correlations with visual analogue scales (ranging from 0.86 to 0.95) with higher compliance and ease of use, particularly in older adults and individuals with motor difficulties (Hjermstad, Fayers, Haugen, et al., 2011). These scales have been also been shown to be used reliably in the Brief Pain Inventory (Cleeland & Ryan, 1994) and has demonstrated high test-retest reliability in chronic pain samples ($r=0.963$; Ferraz, Queresma, Aquino, et al., 1990).

Pain Disability

The Pain Disability Index (PDI; Pollard, 1984) is a seven-item self-report measure that assesses the degree to which individuals believe their pain interferes with various activities in their daily lives. The seven items assessed include occupation, family/home responsibilities, sexual behavior, self-care, recreation and social and life support activities. Items are rated from 0 (no disability) to 10 (total disability). Principle component analyses have demonstrated that all seven items load onto a one-factor solution illustrating this measure best captures overall disability as opposed to individual scores of disability, with factor loadings ranging from 0.56 (e.g. self-care) to 0.91 (e.g. occupation) (Tait, Chibnall, & Krause, 1990). Further, Tait and colleagues (1990) demonstrated the internal consistency was good for this one-factor solution, with a Cronbach's $\alpha=0.86$. The same study also determined the items could fit into a two-factor solution as well, consistent with previous research (Tait et al., 1987) with the first factor being voluntary activities (sexual, recreational, occupational, family/home responsibilities, and social items) and the second factor being involuntary activities (self-

care and life support items). However, internal consistency for these two factors had a good Cronbach's alpha of 0.85 (for voluntary items) and a fair Cronbach's alpha of 0.70 (for involuntary items) (Tait et al., 1990). As a result, much of research reports scores as an overall disability score consistent with the one-factor solution. Concurrent and construct validity is also reported as high (Tait, Chibnall, & Krause, 1990). Also, there is good internal consistency for this measure in chronic pain samples consistent with the validation study (Cronbach's alpha = 0.86). In general, psychometric properties have been reported as adequate (Turk & Melzack, 2001). In this study's sample, the measure demonstrated similarly good internal consistency using the overall disability score (Cronbach's alpha = .89)

Quality of Life

The Medical Outcomes Study: Short-Form 12-Item Health Survey (SF-12) is a 12-item, self-report measure that assesses quality of life and in two overall domains: physical component summary (PCS) and mental component summary (MCS). Each subscale produces a score out of 100, where higher values indicate higher rates of quality of life in physical, mental, social and overall quality of life. It was adapted from the original 36-item measure and has shown to be highly correlated with the longer form (Wee, Davis & Hamel, 2008). The SF-12 has also been shown to be reliable and valid and has been used on a wide variety of various health populations (Ware, Kosinski, & Keller, 1996). The SF-12 has also been shown to have strong internal reliability consistency in a sample of individuals with chronic pain (Cronbach's alpha = .85; Luo et al., 2003). Given these findings and to reduce patient burden, the short-form was used in

the current study. In this study's sample, the measure demonstrated similarly good internal consistency (Cronbach's $\alpha = .84$)

Attention Checks

Each questionnaire being administered included one 'attention check' randomly around the middle of the measure. This 'attention check' said, "Write the number # next to this statement." depending on the Likert scale being used for that question. These attention checks were used to ensure participants were reading questions carefully as they were responding. Participants who failed at least two of the attention checks were administratively withdrawn from the study and had their data removed from analysis.

Procedure

Participants in this study were adults receiving treatment for chronic pain at the Pain Management Center, a multidisciplinary, interventional pain treatment center at University of Louisville Hospital. They were recruited from April through November 2017. A HIPAA waiver was submitted in order to review inclusion/exclusion criteria in the medical record charts of individuals who come in for appointments, and to determine whether they met inclusion/exclusion criteria for the study prior to being asked to participate. These medical records are physical charts that are kept in a secure, locked file cabinet within the Pain Management Center. Individuals who didn't meet inclusion/meet exclusion criteria based on the information in their chart had their names temporarily stored in a password-protected spreadsheet along with the criteria they were excluded for to ensure these individuals were not contacted for participation for the duration of the study, and, once the study was complete, the spreadsheet was erased.

The participants' medical chart was also reviewed after they consented and completed the study questionnaires in order to extract any missing or unknown information not provided in the questionnaires necessary to complete the dataset (e.g. pain-related diagnoses, previous treatments, pain locations, mental health conditions). Only information asked in the study questionnaires was collected and used from these charts. This information was kept with the participants' study questionnaire data in a secure, de-identified database.

Potential participants were approached during the time of their appointment, given a brief description of the study to determine interest and informed that they will be asked screening questions to determine eligibility. They were also informed that they could potentially be deemed ineligible to continue. Additionally, participants were informed in the consent process that any information they provide in the study questionnaires would not be released to their physician or other healthcare providers. Participants still interested reviewed the combined consent and research authorization form with the co-principle investigator or research assistant, and then consented using written signature. Participants who did not pass screening questions were administratively withdrawn due to screen failure.

Those individuals who were still eligible following screening questions completed self-report questionnaires over the course of their appointment time with a clipboard and chair, completing questionnaires in the waiting room prior to their appointment, and/or in the exam room prior to waiting for their physician. Those who still had questionnaires to complete after their appointment either stayed in their exam room to finish or completed them in the waiting room area. Participants were given the opportunity to fill out

questionnaires in this manner given its ecological validity for participating in research in healthcare settings and to reduce time burden on the participant given the considerable wait time for appointments.

Participants who had access to the internet were given the option to complete the study questionnaires through the secure, online database, REDCap either in the office or outside of the office. They were asked to provide their e-mail address and sent an online survey link and unique code assigned to them. They were also informed that their e-mail address and name would be stored in a secure, confidential database for the duration of the study and erased once their participation was completed. Online participants were also informed that questionnaires must be filled out within one day's time due to some questions having a temporal component. Those who did not have access to the internet and wanted to complete the questionnaires in paper-and-pencil format were informed that they must be completed during the time of their visit to ensure security of the data.

Data Preparation and Statistical Analysis

Data Entry

All questionnaire data were double-entered into the IBM SPSS Statistics program (Version 21) and checked to verify accuracy of data entry.

Power Analysis

A prior power analysis was based on the largest and main analysis (Aim 2). This analysis included a linear multiple regression (fixed model, R^2 deviation from zero) with five predictor variables (gender, income level, self-compassion, mindfulness and acceptance). Using G*Power, for an effect size of 0.2 and power of 0.9, total minimum sample size needed would be 89 participants. Actual sample size was 84, so post-hoc

power analysis was conducted and adjusted accordingly with an effect size of 0.2 and power of .88, still above the allowable limit of .8 to avoid a Type II error.

Hypothesis testing indicated statistically significant correlations between age and negative affect. As a result, hypothesis 3b included a separate hierarchical linear multiple regression (fixed model, R^2 deviation from zero) with six predictor variables (age, gender, income level, self-compassion, mindfulness and acceptance). Post-hoc power analysis indicated to determine an effect size of 0.2, power for this analysis would be 0.86, still within allowable limits to avoid a Type II error.

Descriptive Statistics

Descriptive statistics were calculated for demographic variables collected (e.g. age, sex, ethnicity, education level, socioeconomic status), medical variables (e.g. BMI, pain duration, primary pain location) and psychological variables (e.g. psychological symptoms before and after pain). Where appropriate, means, standard deviations and ranges were calculated (e.g. age of participants, BMI, pain duration) and for other variables, frequencies were calculated (e.g. ethnicity, education level).

Hypothesis Testing

Hypothesis 1. Self-compassion will be significantly positively associated with positive emotion, and significantly negatively associated with negative emotion, pain severity, disability and quality of life.

The current study used Pearson bivariate correlational and Spearman's rank-order correlation analyses to examine the associations between self-compassion (as measured by the SCS), positive and negative emotion (as measured by the PANAS and mDES),

pain severity (as measured by the NRS), disability (as measured by the PDI) and the physical (PCS) and mental (MCS) components of quality of life (as measured by the MOS SF-12). Prior to analyses, assumptions of normality, linearity and homoscedasticity were tested for Pearson bivariate correlations. The negative affect subscale of the mDES and the physical component (PCS) of quality of life (SF-12) had significantly positively skewed distributions with z-skew scores above 1.96, and as a result, non-parametric Spearman's rank-order correlational analyses were also run on all variables to determine any significant differences on these variables when correlated with self-compassion.

Hypothesis 2. Using the modified Differential Emotions Scale (mDES), positive affect will be more strongly positively associated with self-compassion than positive affect as measured by the PANAS. There will still be a significant relationship between positive affect as measured by the mDES and Self-Compassion Scale even when positive affect as measured by the PANAS is controlled for.

The current study used Pearson bivariate correlational analyses to examine the relationship between the Self-Compassion Scale and positive affect as measured by the modified Differential Emotions Scale (mDES) and the Positive and Negative Affect Schedule (PANAS), in order to determine whether positive affect as measured by the mDES is more strongly positively correlated with self-compassion than positive affect as measured by the PANAS. Partial correlations were then conducted to determine whether positive affect on the mDES still has significant associations with self-compassion even when the positive affect subscale of the PANAS is controlled for. Assumptions for valid

testing of these partial correlations, including continuous variables, linearity, normal distribution and no significant outliers, were all met.

Hypothesis 3a-b. Using multiple linear regression analyses, self-compassion would predict significantly unique variance in (a) positive and (b) negative emotion, independent of contributions from mindfulness and acceptance.

To examine the unique contributions of each independent variable (self-compassion, mindfulness and pain acceptance), controlling for potential covariates, two multiple regression analyses were conducted with positive affect as the dependent variable (as measured by the mDES) and another with negative affect (as measured by the mDES) as the dependent variable. Gender and income level were chosen a priori as covariates for all analyses due to research evidence supporting various differences in pain-related outcomes across gender (Greenspan, Craft, LeResche, et al., 2007) and income level (Fuentes, Hart-Johnson, & Green, 2007). Age was chosen as an additional covariate in the analysis with negative affect as the dependent variable due to significant correlations between age and negative affect.

Assumptions required for multiple regression were tested prior to running analyses. Specifically, the dependent variable was continuous and all independent variables were either continuous or nominal (e.g. gender) variables. There was one participant with a studentized deleted residual greater than ± 3 standard deviations, but there were no leverage values greater than 0.2, and no values for Cook's distance above 1. Additionally, there was no evidence of multicollinearity, as assessed by tolerance values greater than 0.1. All variables also roughly had linear relationships. Distributions also

met assumptions of independence of residuals with Durbin-Watson's values around 2. In terms of homoscedasticity, negative affect as measured by the mDES failed this test which may have been due to a positively skewed distribution (z-skewness score = 3.06). Therefore, this scale's values were transformed using square root transformation, reducing the z-skewness value to 1.92, correcting it to be within normal distribution range (<1.96) and removing the one case that had a studentized residual greater than ± 3 standard deviations. As a result of this transformation, assumption of heteroscedasticity was also met.

Two hierarchical multiple regression analyses were run, one with positive affect (as measured by the mDES) as the dependent variable, and the other with negative affect (as measured by the mDES, with the square root transformed variable and a comparison analysis with the non-transformed variable). Each of the two multiple regression analyses were run in three blocks, with potential covariates (gender, income level) in the first block/model for positive affect, adding age as well for negative affect; mindfulness (as measured by the MAAS) and pain acceptance (as measured by the CPAQ) entered into the second block/model; and self-compassion (as measured by the SCS) entered into the third block/model. The third model was compared with the second model to determine if there was any significant change in R squared with the addition of self-compassion. This change in R squared when self-compassion was added indicates the amount of absolute variance contributed specifically by self-compassion out of all possible sources of variance (e.g. variance contributed by other predictors in the model tested; variance contributed by predictors not tested; variance due to individual differences or error). Due to no significant changes in the pattern of the multiple regression results between

utilizing the transformed versus non-transformed variable for negative affect, the results were based on models including the non-transformed variable due to easier interpretability and generalizability of the data. Also, removing the participant with outlier data did not change the overall significance pattern of the results and since there was no apparent error with their data, they were included in the final analysis as well.

Hypothesis 4a-c. Using multiple linear regression analyses, self-compassion would predict significantly unique variance in (a) pain severity, (b) disability and (c) quality of life, independent of contributions from mindfulness and acceptance.

To examine the unique contributions of each resilience factor (self-compassion, mindfulness and pain acceptance), four multiple regression analyses were conducted with pain severity, pain disability, and quality of life (mental and physical components) as the dependent variables. Gender and income level were also entered as covariates for all analyses.

Assumptions required for multiple regression were tested prior to running analyses. Specifically, the dependent variable was continuous and all independent variables were either continuous or nominal (e.g. gender) variables. There were no studentized deleted residuals greater than ± 3 standard deviations, no leverage values greater than 0.2, and no values for Cook's distance above 1. Additionally, there was no evidence of multicollinearity, as assessed by tolerance values greater than 0.1. All variables also roughly had linear relationships. Distributions also met assumptions of independence of observations/residuals with Durbin-Watson's values around 2. In terms of homoscedasticity, the physical component of the quality life measure (PCS as

measured by the SF-12) failed the test which may have been due to a highly positively skewed distribution (z-skewness score = 3.66). Therefore, this scale's values were transformed using the logarithmic transformation, reducing the z-skewness value to 1.17, correcting it to be within normal distribution range (<1.96) and also meeting assumption of homoscedasticity.

Four hierarchical multiple regression analyses were run, one with average pain severity (as measured by the NRS) as the dependent variable, the second with pain disability (as measured by the PDI), the third with the mental component of quality of life (SF-12 – MCS) and the fourth with the physical component of quality of life (SF-12 – PCS; with the logarithmic transform variable and a comparison analysis with the non-transformed variable). Each of the four multiple regression analyses was run in three blocks, with potential covariates (gender, income level) in the first block/model; mindfulness (as measured by the MAAS) and pain acceptance (as measured by the CPAQ) entered into the second block/model; and self-compassion (as measured by the SCS) entered into the third block/model. The third model was compared with the second model to determine if there was any significant change in R squared with the addition of self-compassion. This change in R squared when self-compassion was added indicates the amount of absolute variance contributed specifically by self-compassion out of all possible sources of variance (e.g. variance contributed by other predictors in the model tested; variance contributed by predictors not tested; variance due to individual differences or error). Due to no significant changes in the pattern of the multiple regression results between utilizing the transformed versus non-transformed variable for

the physical component of quality of life, the results are based on models including the non-transformed variable due to easier interpretability and generalizability of the data.

Hypothesis 5a-b. Using moderation analyses, the interaction between pain severity and self-compassion would predict unique and statistically significant variance in a) positive and b) negative affect. Specifically, self-compassion would moderate the relationship between pain severity and affect by a) attenuating the effects of pain severity on decreasing positive affect and b) attenuating the effects of pain severity on increasing negative affect; even when pain severity is high.

Two linear regression analyses were conducted, one with positive affect as the dependent variable and one with negative affect as the dependent variable, using the average score on the positive and negative affect subscales of the mDES. Average pain severity, self-compassion and the covariate, income level, were entered into the first block for both negative and positive emotion. For negative emotion, the covariate, age, was also entered into the first block since age was significantly correlated with negative affect and a significant predictor in the multiple regression model from Hypothesis 4b. Gender was omitted from these analyses given that there were no significant group differences in outcome variables based on gender, and gender did not predict significant variance in any of the multiple regression analyses from Aim 3.

The moderating effect was tested with the interaction term, average pain severity multiplied by self-compassion, entered into the second block. The interaction term was mean-centered for easier interpretation of regression coefficients and to reduce issues of multicollinearity between the main effect terms and the interaction term. Pain severity

was an insignificant predictor of positive emotion in the first block with self-compassion and income level. In order to better understand these relationships, the moderation analysis with positive emotion as the dependent variable was re-fitted with three models (first block with income level and pain severity; second block with income, pain severity and self-compassion; third block with the interaction term). Moderation analyses were also run through the PROCESS add-on tool (Hayes & Mathes, 2009) in order to obtain simple slopes analysis and determine the relationship between average pain severity and positive or negative affect at low, mean and high levels of self-compassion.

Assumptions tested for the moderation analysis were the same as the multiple regression analyses from hypothesis 3 and 4. All assumptions were met for the moderation analysis with positive affect as the outcome. For negative affect, two participants had studentized deleted residuals above 3 standard deviations. Although there was no identifiable data entry errors in these participants' data, moderation analyses were run with and without the two subjects to determine if there were any significant differences in the pattern of findings.

Hypothesis 6a-b. Using moderation analyses, the interaction between pain severity and self-compassion would predict unique and statistically significant variance in a) pain disability and b) quality of life. Specifically, self-compassion would moderate the relationship between pain severity and functional outcomes by a) attenuating pain severity's effect on increasing pain disability and b) attenuating pain severity's effect on decreasing quality of life; even when pain is high.

Three linear regression analyses were conducted with the following dependent variables: pain disability (PDI), and the mental (MCS) and physical components (PCS) of

quality of life, separately. In each regression analysis, average pain severity, self-compassion and the covariate, income level, were entered into the first block. Similarly to Hypothesis 5a-b, gender was also omitted as a covariate in these analyses due to insignificant findings based on this variable. The moderating effect was tested with the interaction term, average pain severity multiplied by self-compassion, entered into the second block. The interaction term was mean-centered for easier interpretation of regression coefficients and reduce issues of multicollinearity between the main effect terms and the interaction term. Moderation analyses were also run through the PROCESS add-on tool (Hayes & Mathes, 2009) in order to obtain simple slopes analysis and determine the relationship between average pain severity and the three functional variables (pain disability, mental component of QoL, and physical component of QoL) at low, mean and high levels of self-compassion.

Assumptions tested for the moderation analysis were the same as the multiple regression analyses from hypothesis 3 and 4. All assumptions were met for pain disability and the mental component of QoL as the outcome variables. For the physical component, one participant had a studentized deleted residual above 3 standard deviations. This participant was not one of the participants identified as an outlier in the moderation analysis for negative affect. Although there was no data entry error in this participant's data, moderation analyses were run with and without the subject to determine if there were any significant differences in the pattern of findings.

CHAPTER III

RESULTS

Sample Characteristics

150 patients with the Pain Management Center were invited to participate in the study. Of these participants, 103 consented to participate. Of the participants who consented, 10 participants screen failed due to meeting one or more exclusion criteria, including current cancer diagnosis ($n = 5$), cognitive disorder (e.g. dementia; $n = 3$), schizophrenia or other psychosis-related disorder ($n = 2$) and not meeting criteria for chronic pain (pain less than 3 months; $n = 1$). Seven participants were administratively withdrawn due to not completing half or more of the questionnaires due to time constraints ($n = 3$), not starting questionnaires through REDcap ($n = 2$) or failing two or more attention check questions ($n = 2$). Two participants self-withdrew from the study due to some questionnaires making them uncomfortable; research staff debriefed these individuals prior to their withdrawal and discussed their concerns. There were no significant group differences between completers and non-completers in the study. The total sample in the study included 84 participants with completed questionnaires.

Sample participants ranged in age from 19 to 82 years old, with an average age of 53 years old ($SD = 11.46$). Participants' weight ranged from 115 to 380 pounds, with an average weight of 207.9 pounds ($SD=58.14$). BMI ranged from 19 to 56, with an average

BMI of 33 (SD=8.48). Sample participants were more likely to be female (63.1%), Caucasian (63.1%), obese (56%), currently married (42.9%), live with a spouse or partner (33.3%), disabled or retired (48.8%), earn a combined household income between \$5,000 and \$19,999 (29.8%) and have some college education (36.9%). Detailed sociodemographic characteristics of the sample that met inclusion criteria and completed all parts of the study can be found in Table 5. Sample sociodemographic characteristics compared to others in the recruitment city, county, state and U.S. overall are presented in Table 6 (US Census Bureau, <https://www.census.gov/quickfacts>).

Pain Characteristics

Table 7 outlines pain-related characteristics in this sample. Most participants were coming into the clinic for follow-up appointments (70.2%), followed by initial appointments (16.7%) and procedures (13.1%). Pain severity was measured on a numerical scale ranging from 0 (no pain) to 10 (worst pain). Current and average pain were roughly similar, with a mean of 5.44 (SD=2.45) for current pain and 5.25 (SD=1.91) for average pain over the last week. Mean score for lowest pain over the last week was 3.67 (SD=2.08) and 7.73 (SD=1.95) for highest pain over the last week. In order to maintain temporal consistency with the affect measures, average pain severity over the last week will be used throughout all main analyses. Participants reported experiencing pain for an average of about 9 years (M=9.09; SD=6.84) with half of the participants reporting three or more pain areas (50%). The site of pain most commonly reported as the worst area was the low back (69%). The most common pain diagnosis was bulging or herniated disc (64.3%) followed closely by degenerative disc disease (63.1%). The most common treatments tried for pain were prescription medications (e.g. narcotic pain

medications, muscle relaxers; 91.7%), over-the-counter medications (81%), physical therapy (75%) and anesthetic injections (73.8%). Of these treatments tried, participants reported the most successful treatments as prescription medications (69%) and anesthetic injections (56%).

Psychological Characteristics

Table 8 illustrates the psychological characteristics of the sample. Prior to developing chronic pain, the most commonly reported psychological disturbance in this sample were sleeping problems (50%), followed by depression (36.9%); however, 63.1% of the sample reported no psychological difficulties prior to developing chronic pain. Most sample participants reported some type of psychological disturbance after developing chronic pain, with the most reported being sleep difficulties (81%) and depression (65.5%). Only 9.5% of the sample denied any psychological difficulties since developing chronic pain. Additionally, 20.2% of sample participants endorsed trying counseling or therapy to treat their chronic pain, of which 5.9% found it to be successful. A total of 31% of the sample participants endorsed having a psychiatric diagnosis.

Descriptive Characteristics of Study Measures and Subscales

The means and standard deviations for each study measure total score and subscale are listed on Table 9.

Demographic Differences

Independent sample t-tests were analyzed in order to determine whether there were any significant differences related to gender or ethnicity on the study variables, including self-compassion, chronic pain acceptance, mindfulness, positive and negative affect (on both the PANAS and mDES), average pain severity, pain disability and quality

of life. Although gender will be entered as a covariate into the multiple regression analyses as it was chosen a priori, results of these analyses demonstrated no significant differences on study variables between men and women when compared at the .05 alpha level. Similarly, results on independent sample t-tests demonstrated no significant differences on study variables between Caucasian and African American participants when compared at the .05 alpha level. Additionally, these tests also demonstrated no significant differences on study variables between participants with a high school diploma or less and those with more than a high school diploma when compared at the .05 level. Pearson bivariate correlations were run to test for significant correlations between participant age and scores on study measures. Age was found to be significantly correlated with negative affect (per the mDES; $r = -.237$, $p < .05$ and PANAS; $r = -.218$, $p < .05$). Since age is related to negative affect, subsequent study analyses pertaining to negative affect controlled for this variable.

One-way ANOVA analyses were run to determine if there were significant differences on study variables based on different levels of income. All variables met criteria for Levene's test for homogeneity of variances with the exception of the physical component of the quality of life measure, and as a result, the Welch ANOVA F-test was reported for this variable. Results from these analyses indicated significant group differences in average pain severity, $F(5, 78) = 6.57$, $p < .001$; pain acceptance, $F(5, 78) = 6.04$, $p < .001$; pain disability, $F(5, 78) = 5.22$, $p < .001$; and the physical components of quality of life, Welch's $F(5, 21.026) = 5.13$, $p < .005$. Specifically, post-hoc multiple comparisons using Tukey's HSD showed that there were significantly higher mean scores on average pain severity and lower mean scores in pain acceptance in those who made

less than \$20,000 per year when compared with those who made greater than \$100,000 per year ($p < .05$). There were also significantly higher mean scores on pain disability and lower mean scores on the physical component of quality of life in those who made less than \$20,000 per year when compared with those who made greater than \$150,000 per year ($p < .05$). Due to significant group differences in income level across variables, income was entered in as a covariate for all regression analyses.

Given that patient visit type (initial visit, procedure, or follow-up) was not consented to be collected prior participation in the study, post-hoc analyses were conducted to determine if there were any significant differences based on this variable. Using one-way ANOVA analyses, results demonstrated that there were no significant differences on study variables found based on appointment type.

Associations Between Affect, Pain Severity and Disability and QoL

Pearson bivariate correlations between positive and negative affect, average pain severity and disability, and mental and physical QoL can be found in Table 10.

Associations Between Self-Compassion, Mindfulness and Acceptance

Pearson bivariate correlations between self-compassion and its subscales, mindfulness, pain acceptance and its subscales, can be found in Table 11.

Hypothesis Testing

Hypothesis 1. Self-compassion will be significantly positively associated with positive emotion, and significantly negatively associated with negative emotion, pain severity, disability and quality of life.

Pearson bivariate correlations supported this hypothesis in the predicted directions, demonstrating that those with higher self-compassion also experienced higher

positive emotion ($r=.46, p<.001$ on the PANAS and $r=.54, p<.001$ on the mDES) as well as lower negative emotion ($r= -.59, p<.001$ on the PANAS and $r= -.58, p<.001$ on the mDES). Additionally, participants who reported higher self-compassion also reported lower average pain severity over the past week ($r= -.29, p<.01$), lower pain disability ($r= -.50, p<.001$) and higher quality of life (mental component, $r=.58, p<.001$ and physical component, $r=.24, p<.05$). Pearson and Spearman's rho correlation tables demonstrated no significant differences in relationships between self-compassion and other hypothesized variables, with the exception of the relationship between self-compassion and the physical component of quality of life (PCS), $r_s = .208, p=.057$, for which the correlation became marginally insignificant. Results of Pearson correlational analyses examining the relationships between overall self-compassion scores, as well as its individual subscales, with dependent variables are provided in Table 12.

Hypothesis 2. Using the modified Differential Emotions Scale (mDES), positive emotion will be more strongly positively associated with self-compassion than positive emotion as measured by the PANAS, and there will still be a significant relationship between the mDES and Self-Compassion Scale even when affect as measured by the PANAS is controlled for.

Study findings supported this hypothesis' predictions. Pearson bivariate correlations demonstrated that self-compassion was more highly correlated with positive affect as measured by the mDES ($r=.538, p<.001$) than with positive emotion as measured by the PANAS ($r=.464, p<.001$). A partial correlation was run to determine the relationship between positive emotion as measured by the mDES and self-compassion

when positive emotion as measured by the PANAS was controlled for. Results from this analysis indicated the relationship between positive emotion as measured by the mDES and self-compassion was still statistically significant ($r=.34, p<.005$). Thus hypothesis 2 was supported and, as a result, the mDES was used for all subsequent analyses.

Hypothesis 3a. Self-compassion would predict significant and unique variance in positive emotion/affect, in addition to mindfulness and pain acceptance.

Pearson bivariate correlations between self-compassion, mindfulness and pain acceptance and positive affect are available in Table 13. Results from hierarchical regression analyses (see Table 14) indicated that the overall regression model of mindfulness, pain acceptance and self-compassion and covariates, gender and income level, predicting positive affect as measured by the mDES (Model 3) was statistically significant with an $F(5, 78) = 13.67, p < .001$. Additionally, the total amount of variance predicted by this model was $R^2 = .467, d=.87$, with an adjusted $R^2 = .433, d=.76$. This indicates that this five-predictor model predicted 46.7% of the variance in positive emotion, or when adjusted to the sample, 43.3% of the variance in positive emotion, and demonstrates a large effect size according to Cohen (1988).

The addition of self-compassion to the prediction of positive affect as measured by the mDES (Model 3), in addition to covariates, gender and income level, mindfulness and pain acceptance, led to a statistically significant F-change in the model, $F(1, 78) = 9.18, p < .01$. The proportion of variance contributed to the overall model by self-compassion was $R^2 = .063, d=.07$ indicating that self-compassion accounts for statistically significant and unique variance in positive emotion of 6.3%, above and beyond

mindfulness and pain acceptance, as well as the two covariates, with an effect size between small and medium. The individual predictors were examined further and indicated that self-compassion ($\beta=.31$, $t(78) = 3.03$, $p<.01$) and pain acceptance ($\beta=.55$, $t(78)=4.82$, $p<.001$) were the only significant predictors in the five-predictor model.

Exploratory post-hoc exploratory analyses were run to determine what aspects of pain acceptance were contributing significant variance to changes in positive emotion due to previous research suggesting that the Activity Engagement subscale fully mediated the relationship between pain acceptance and positive emotion (Kranz, Bollinger and Nilges, 2010). Results examining activity engagement and pain willingness separately found that activity engagement was driving the significance in predicting variance in positive emotion, $\beta=.05$, $t(77)=5.58$, $p<.001$, while pain willingness was insignificant, $\beta=.002$, $t(77)=.25$, $p=.80$. Overall, hypothesis 3a was supported. Comprehensive regression coefficients, associated standard error and significance values can be found in Table 14.

Hypothesis 3b. Self-compassion would predict significant and unique variance in negative emotion/affect, in addition to mindfulness and acceptance.

Pearson bivariate correlations between self-compassion, mindfulness and pain acceptance and negative affect are available in Table 13. Results from hierarchical regression analyses (see Table 15a) indicated that the overall regression model of mindfulness, pain acceptance and self-compassion and covariates, gender and income level, predicting negative affect as measured by the mDES (Model 3) was statistically significant with an $F(5, 78) = 10.15$, $p < .001$. Additionally, the total amount of variance predicted by this model was $R^2 = .394$, $d=.65$, with an adjusted $R^2 = .355$, $d=.55$. This indicates that this five predictor model predicted 39.4% of the variance in negative affect,

or when adjusted to the sample, 35.5% of the variance in negative affect, and demonstrates a large effect size according to Cohen (1988).

The addition of self-compassion to the prediction of negative affect as measured by the mDES (Model 3), in addition to covariates gender and income level, mindfulness and pain acceptance, led to a statistically significant F-change in the model, $F(1, 78) = 18.24, p < .001$. The proportion of variance contributed to the overall model by self-compassion was $R^2 = .142$, indicating that self-compassion accounts for statistically significant and unique variance in negative affect of 14.2%, above and beyond mindfulness and pain acceptance, as well as the two covariates, with a medium effect size ($d = .17$). The individual predictors were examined further and indicated that self-compassion ($\beta = -.46, t(78) = -4.27, p < .001$) was the only significant predictor in the five-predictor model.

Given that age was statistically significantly correlated with negative affect (as measured by the PANAS and mDES), hierarchical regression analyses were also included with age entered in as a covariate to determine whether self-compassion still contributed unique and statistically significant variance in changes in negative affect (see Table 15b). The overall regression model of mindfulness, pain acceptance and self-compassion and covariates, gender, income level, and age predicting negative affect as measured by the mDES (Model 3) was statistically significant with an $F(6, 77) = 9.54, p < .001$. Additionally, the total amount of variance predicted by this model was $R^2 = .426, d = .74$, with an adjusted $R^2 = .382, d = .50$. This indicates that this six-predictor model predicted 42.6% of the variance in negative affect, or when adjusted to the sample, 38.2% of the

variance in negative affect, and demonstrates a large effect size according to Cohen (1988).

When age was added as a covariate to the overall model, the addition of self-compassion to the prediction of negative affect as measured by the mDES (Model 3), in addition the other two covariates, gender and income level, mindfulness and pain acceptance, still led to a statistically significant F-change in the model, $F(1, 77) = 15.56, p < .001$. The proportion of variance contributed to the overall model by self-compassion in the model including age was $R^2 = .116$, indicating that self-compassion accounts for statistically significant and unique variance in positive emotion of 11.6%, above and beyond mindfulness and pain acceptance, as well as three covariates, with approximately a medium effect size ($d = .13$). When examining individual predictors in this six-predictor model including age, it was indicated that age was also a significant predictor of negative affect ($\beta = -.18, t(77) = -2.08, p = .04$) as well as self-compassion ($\beta = -.42, t(77) = -3.95, p < .001$). Comprehensive regression coefficients, associated standard error and significance values can be found in Table 15a-b.

Hypothesis 4a: Self-compassion would predict significant and unique variance in pain severity, in addition to mindfulness and acceptance.

Pearson bivariate correlations between self-compassion, mindfulness and pain acceptance and pain severity are available in Table 13. Results from hierarchical regression analyses (see Table 16) indicated that the overall regression model of mindfulness, pain acceptance and self-compassion and covariates, gender and income level, predicting pain severity (Model 3), was statistically significant with an $F(5, 78) = 7.60, p < .001$. Additionally, the total amount of variance predicted by this model was $R^2 =$

.328, $d=.49$, with an adjusted $R^2 = .285$, $d=.40$. This indicates that this five predictor model predicted 32.8% of the variance in average pain severity, or when adjusted to the sample, 28.5% of the variance in average pain severity, and demonstrates a large effect size according to Cohen (1988).

The addition of self-compassion to the prediction of average pain severity (Model 3), in addition to covariates gender and income level, mindfulness and pain acceptance, did not contribute a statistically significant F-change in the model, $F(1, 78) = .90$, $p=.35$. The proportion of variance contributed to the overall model by self-compassion was $R^2=.008$, indicating that self-compassion accounted for only .8% of the variance in average pain severity above and beyond mindfulness and pain acceptance, as well as the two covariates, gender and income level (see Table 16). Thus, hypothesis 4a is not supported.

Further analyses revealed that the addition of mindfulness and pain acceptance to the prediction of average pain severity (Model 2) in addition to covariates, gender and income, also did not contribute to a statistically significant F-change in the model, $F(2, 79) = 3.06$, $p=.053$, although this was marginally insignificant. Examining the individual predictors of the five-predictor model indicated that income level was the only significant predictor of pain severity ($\beta = -.38$, $t(78)=-3.43$, $p=.001$) in the five-predictor model. As a result, Model 1 (with gender and income level) was the best model of the three models to predict variance in average pain severity, accounting for statistically significant variance in average pain severity, $F(2, 81) = 14.77$, $p<.001$, with an $R^2=.267$, or 26.7% of the variance in average pain severity and a medium effect size ($d=.36$), and adjusted $R^2=.249$, or 24.9% of the variance in average pain severity when adjusted to the sample, with a

medium effect size ($d=.33$). Comprehensive regression coefficients, associated standard error and significance values can be found in Table 16.

Hypothesis 4b: Self-compassion would predict significant and unique variance in pain disability, in addition to mindfulness and acceptance.

Pearson bivariate correlations between self-compassion, mindfulness and pain acceptance and pain disability are available in Table 13. Results from hierarchical regression analyses (see Table 17) indicated that the overall regression model of mindfulness, pain acceptance and self-compassion and covariates, gender and income, predicting pain disability as measured by the PDI (Model 3) was statistically significant with an $F(5, 78) = 17.60, p < .001$. Additionally, the total amount of variance predicted by this model was $R^2 = .530, d=1.13$, with an adjusted $R^2 = .500, d=1.00$. This indicates that this five predictor model predicted 53.0% of the variance in pain disability, or when adjusted to the sample, 50.0% of the variance in pain disability, and demonstrates a large effect size according to Cohen (1988).

The addition of self-compassion to the model prediction of pain disability as measured by the PDI (Model 3), in addition to covariates gender and income level, mindfulness and pain acceptance, led to a statistically significant F-change in the model, $F(1, 78) = 4.42, p < .05$. The proportion of variance contributed to the overall model by self-compassion was $R^2 = .027$, indicating that self-compassion accounts for statistically significant and unique variance in pain disability of 2.7%, above and beyond mindfulness and pain acceptance, as well as the two covariates, with a small effect size ($d=.03$). Further, examining the individual predictors of the five-predictor model indicated that

self-compassion ($\beta = -.20$, $t(78) = -2.10$, $p < .05$) and pain acceptance ($\beta = -.52$, $t(78) = -4.83$, $p < .001$) were the only significant predictors of pain disability. Exploratory post-hoc analyses examining activity engagement and pain willingness separately found that activity engagement and pain willingness both accounted for this significance. Overall, hypothesis 4b was supported. Comprehensive regression coefficients, associated standard error and significance values can be found in Table 17.

Hypothesis 4c: Self-compassion would predict significant and unique variance in quality of life, in addition to mindfulness and acceptance.

Pearson bivariate correlations between self-compassion, mindfulness and pain acceptance and the mental and physical components for quality of life are available in Table 13. Two separate hierarchical regression analyses were run with the mental component of quality of life (MOS SF-12 - MCS) and the physical component of quality of life (MOS SF-12 - PCS). Results from hierarchical regression analyses (see Table 18a) indicated that the overall regression model of mindfulness, pain acceptance and self-compassion and covariates, gender and income, predicting the mental component of quality of life (Model 3) was statistically significant with an $F(5, 78) = 13.28$, $p < .001$. Additionally, the total amount of variance predicted by this model was $R^2 = .460$, $d = .85$, with an adjusted $R^2 = .425$, $d = .74$. This indicates that this five predictor model predicted 46.0% of the variance in the mental aspect of quality of life, or when adjusted to the sample, 42.5% of the variance, and demonstrates a large effect size according to Cohen (1988).

The addition of self-compassion to the prediction of the mental component of quality of life (Model 3), in addition to covariates gender and income level, mindfulness

and pain acceptance, led to a statistically significant F-change in the model, $F(1, 78) = 11.97, p = .001$. The proportion of variance contributed to the overall model by self-compassion was $R^2 = .083$, indicating that self-compassion accounts for statistically significant and unique variance in the mental component of quality of life of 8.3%, above and beyond mindfulness and pain acceptance, as well as the two covariates, gender and income level, with an effect size between small and medium ($d = .09$). Thus, this part of hypothesis 4c is supported. Examining the individual predictors of the five-predictor model indicated that self-compassion ($\beta = .35, t(78) = 3.46, p = .001$) and pain acceptance ($\beta = .36, t(78) = 3.11, p < .01$) were the only significant predictors of the mental component of quality of life. Exploratory post-hoc exploratory analyses examining activity engagement and pain willingness separately found that activity engagement was driving the significance in predicting variance in mental QoL, $\beta = .23, t(77) = 2.18, p < .05$, while pain willingness was not significant, $\beta = .19, t(77) = 1.50, p = .14$.

Results from hierarchical regression analyses (see Table 18b) indicated that the overall regression model of mindfulness, pain acceptance and self-compassion and covariates, gender and income, predicting the physical component of quality of life (Model 3) was statistically significant with an $F(5, 78) = 11.67, p < .001$. Additionally, the total amount of variance predicted by this model was $R^2 = .428, d = .75$, with an adjusted $R^2 = .391, d = .64$. This indicates that this five predictor model predicted 42.8% of the variance in the physical health aspect of quality of life, or when adjusted to the sample, 39.1% of the variance, and demonstrates a large effect size according to Cohen (1988).

The addition of self-compassion to the prediction of the physical component of quality of life (Model 3), in addition to covariates gender and income level, mindfulness and pain acceptance, did not contribute a statistically significant F-change in the model, $F(1, 78) = .35, p = .557$. The proportion of variance contributed to the overall model by self-compassion was $R^2 = .003$, indicating that self-compassion accounted for only .3% of the variance in physical quality of life above and beyond mindfulness and pain acceptance, as well as the two covariates, gender and income level. Results of the individual coefficients indicated that pain acceptance ($\beta = .54, t(78) = 4.55, p < .001$) and income level ($\beta = .23, t(78) = 2.25, p = .027$), were the only significant predictors in the total five-predictor model. Exploratory post-hoc analyses examining activity engagement and pain willingness separately found that activity engagement and pain willingness both accounted for this significance. Model 2, which excluded self-compassion, contributed to a statistically significant F-change in the model, $F(2, 79) = 11.76, p < .001$, with $R^2 = .425, d = .74$, and adjusted $R^2 = .396, d = .64$, accounting for a total of 42.5% (or 39.6% when adjusted to the sample) of the variance in physical component of quality of life, with large effect size, and was the best model of the three models. Thus, this part of hypothesis 4c was not supported. Comprehensive regression coefficients, associated standard error and significance values can be found in Table 18a-b.

Hypothesis 5a. The interaction between pain severity and self-compassion would predict statistically significant variance in positive emotion/affect. Specifically, self-compassion would significantly moderate the relationship between pain severity and positive affect, such that higher self-compassion would attenuate the effect of pain severity on decreasing positive affect even when pain severity is high.

Moderation analyses revealed that the interaction between average pain severity and self-compassion did not contribute to significant variance in the model predicting positive affect, $\Delta R^2 = .0004$, $\Delta F(1, 78) = .05$, $b = .02$, $t(78) = .22$, $p = .83$ (see Model 3 in Table 19). Upon further examination of Model 3, only self-compassion was a significant predictor of positive affect ($b = .71$, $t(78) = 5.04$, $p < .001$). Pain severity contributed to significant variance in positive emotion in a model with just income (see Model 1), but did not contribute to significant variance in positive emotion when in the same model as self-compassion, $b = -.09$, $t(78) = -1.76$, $p = .08$ (see Model 2) or in the same model as self-compassion and the interaction term, $b = -.09$, $t(78) = -1.73$, $p = .09$ (see Model 3). Self-compassion had a significant main effect on positive affect, but did not significantly moderate the relationship between pain severity and positive affect (see Figure 1 for plotted results). Hypothesis 5a was not supported.

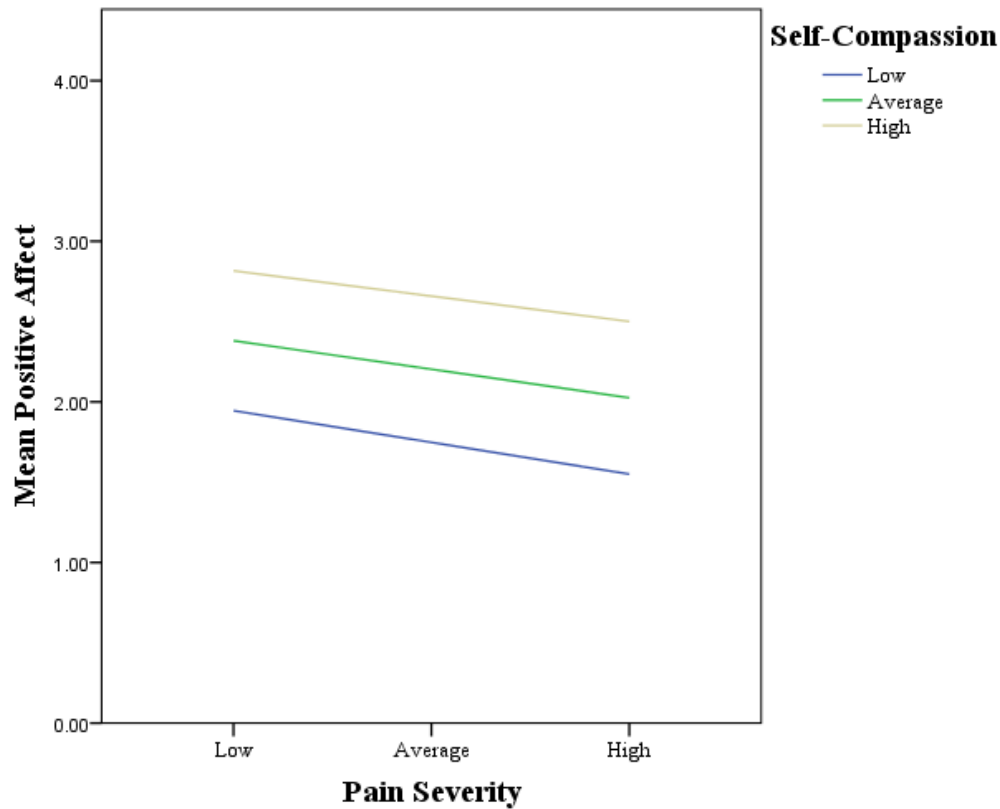


Figure 1. Line graph of self-compassion as a moderator of pain intensity and mean positive affect, controlling for annual household income.

Hypothesis 5b. The interaction between pain severity and self-compassion would predict statistically significant variance in negative emotion/affect. Specifically, self-compassion would significantly moderate the relationship between pain severity and negative affect, such that higher self-compassion would attenuate the effect of pain severity on increasing negative affect, even when pain severity is high.

Moderation analyses were run with and without the two participants with studentized deleted residuals above 3. Results indicated that with these two outliers, the interaction between average pain severity and self-compassion did not contribute to significant variance in the model predicting negative affect, $\Delta R^2 = .02$, $\Delta F(1, 78) = 2.19$,

$b = -.10$, $t(78) = -1.48$, $p = .14$. However, when the two outliers were removed, the interaction term accounted for a significant proportion of the variance in negative affect, $\Delta R^2 = .04$, $\Delta F(1, 76) = 5.98$, $b = -.14$, $t(76) = -2.44$, $p = .017$ (see Table 20a for more details). Thus, self-compassion significantly moderated the relationship between pain severity and negative affect. Given the significant changes in results when the two outliers were removed, it is likely that these participants were following a pattern significantly different from the majority of the sample, and thus simple slopes analysis will be presented to describe the nature of the moderation effect with these outliers removed.

Simple slopes analysis revealed that when self-compassion was low, there was a significant, positive relationship between pain severity and negative affect, $b = .188$, 95% CI [.079, .297], $t = 3.43$, $p = .001$. At average values of self-compassion, there is a significant, positive relationship between pain severity and negative affect, $b = .096$, 95% CI [.011, .181], $t = 2.26$, $p = .03$. At high levels of self-compassion, there is a non-significant, positive relationship between pain severity and negative affect, $b = -.005$, 95% CI [-.112, .122], $t = .08$, $p = .93$. These results indicate that as self-compassion goes up, the relationship between pain severity and negative affect becomes less significant, thus Hypothesis 5b is supported. See Table 20b for detailed simple slopes analyses and Figure 2 for plotted moderation analyses results.

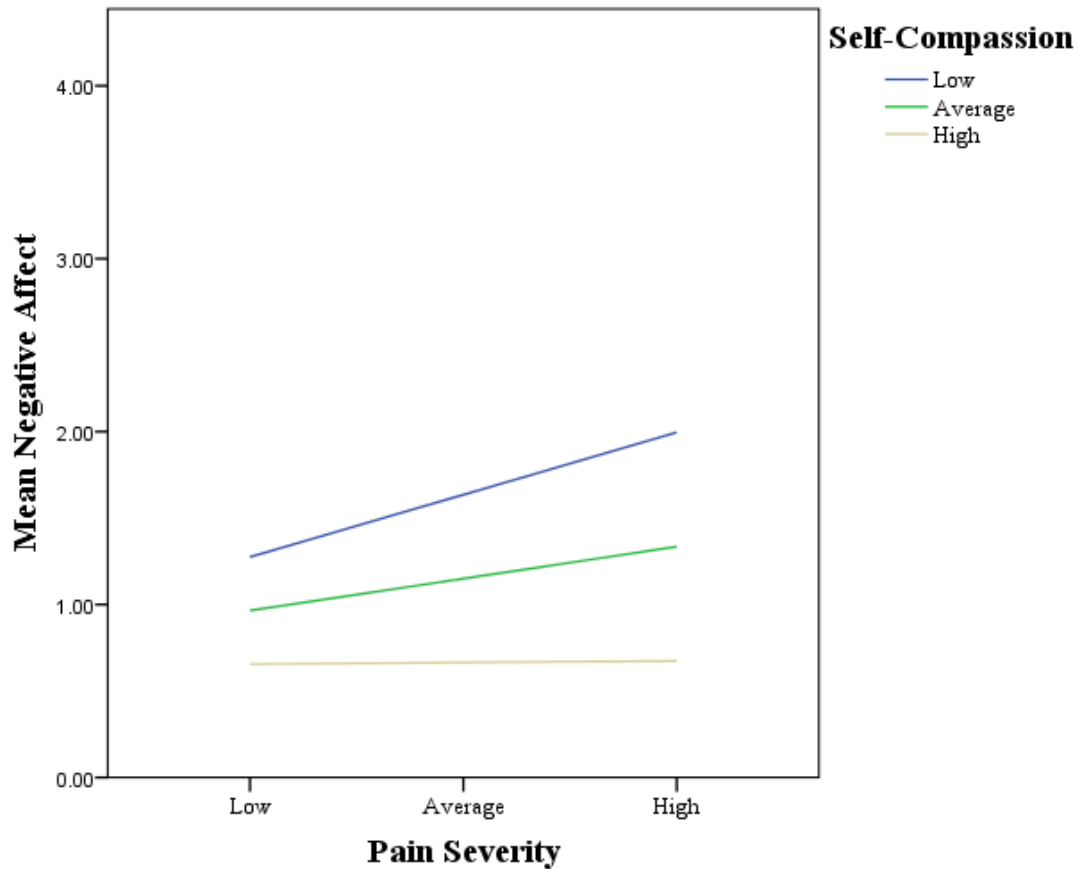


Figure 2. Line graph of self-compassion as a moderator of pain intensity and mean negative affect, controlling for annual household income and age.

Hypothesis 6a. The interaction between pain severity and self-compassion would predict statistically significant variance in pain disability. Specifically, self-compassion will significantly moderate the relationship between pain severity and pain disability, such that higher self-compassion will attenuate pain severity's effect on increasing pain disability, even when pain severity is high.

Moderation analyses examining the interaction effect between pain severity and self-compassion predicting pain disability was non-significant, $\Delta R^2 = .000$, $\Delta F(1, 79) = .01$, $b = .12$, $t(79) = .11$, $p = .92$ (detailed results can be found in Table 21). Thus, self-

compassion does not significantly moderate the relationship between pain severity and pain disability. Hypothesis 6a was not supported. Given that pain acceptance was also a significant predictor of pain disability in Hypothesis 4b, and this hypothesis was exploratory in nature, moderation analyses were run to also examine the interaction effect between pain severity and pain acceptance predicting pain disability and controlling for income. Results from this analysis were also insignificant, $\Delta R^2 = .01$, $\Delta F(1, 79) = 1.69$, $b = 1.04$, $t(79) = 1.30$, $p = .20$.

Hypothesis 6b. Using moderation analyses, the interaction between pain severity and self-compassion would predict unique and statistically significant variance in quality of life. Specifically, self-compassion would moderate the relationship between pain severity and quality of life by attenuating pain severity's effect on reducing quality of life even when pain severity is high.

Moderation analyses were run to examine the interaction effects between self-compassion and pain severity on predicting the mental health and physical components of quality of life separately. Results for the mental component of quality of life were non-significant, $\Delta R^2 = .012$, $\Delta F(1, 79) = 1.70$, $b = 1.04$, $t(79) = 1.30$, $p = .20$ (see Table 22). Thus, self-compassion does not significantly moderate the relationship between pain severity and mental QoL. This part of hypothesis 6b is not supported. Given that pain acceptance, specifically the activity engagement subscale, was also a significant predictor of the mental component of QoL in Hypothesis 4c, and this hypothesis was exploratory in nature, moderation analyses were run to also examine the interaction effect between pain severity and activity engagement predicting mental QoL, controlling for income. Results

from this analysis were also insignificant, $\Delta R^2 = .004$, $\Delta F(1, 79) = .48$, $b = -.03$, $t(79) = -.69$, $p = .49$.

Moderation analyses examining the interaction effects between self-compassion and pain severity on predicting the physical component of quality of life were run with and without the participant with a studentized deleted residual above 3. Results indicated that with the outlier, the interaction between average pain severity and self-compassion was insignificant, $\Delta R^2 = .02$, $\Delta F(1, 79) = 1.68$, $b = -1.01$, $t(79) = -1.30$, $p = .20$. However, when the outlier was removed, the interaction term became statistically significant, $\Delta R^2 = .057$, $\Delta F(1, 78) = 7.01$, $b = -2.18$, $t(78) = -2.65$, $p = .01$; see Table 23a for comprehensive analysis results). Given the significant changes in results when the outlier was removed, it is likely this participant is following a pattern significantly different from the majority of the sample, and thus simple slopes analysis will be presented to describe the nature of the moderation effect with this outlier removed.

Simple slopes analysis revealed that when self-compassion is low, there is a non-significant positive relationship between pain severity and the physical component of QoL, $b = .571$, 95% CI $[-.841, 1.98]$, $t = .806$, $p = .423$. At average values of self-compassion, there is a non-significant negative relationship between pain severity and the physical component of QoL, $b = -.785$, 95% CI $[-1.86, .288]$, $t = -1.46$, $p = .149$. At high levels of self-compassion, there is a significant, negative relationship between pain severity and the physical component of QoL, $b = -2.14$, 95% CI $[-3.69, -.596]$, $t = -2.76$, $p < .01$. These results indicate that the relationship between pain severity and physical QoL only really emerges in participants with high levels of self-compassion, such that when people are high in pain but also high in self-compassion, their physical QoL is lower. Although non-

significant, low levels of self-compassion lead to higher physical QoL even when pain severity is high. Hypothesis 6b is partially supported; there was a significant interaction effect between pain severity and self-compassion on physical QoL, but not in the predicted direction. See Table 23b for simple slopes analysis results in detail and Figure 3 for plotted moderation analyses results.

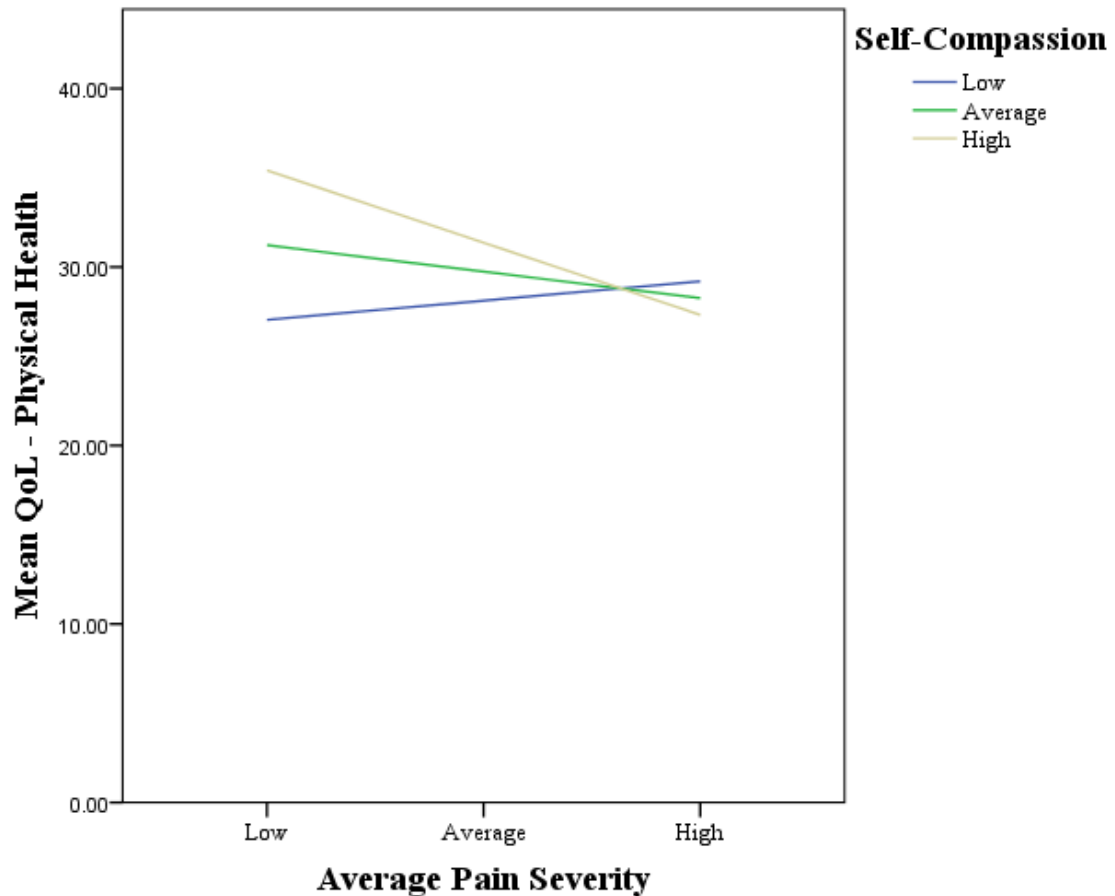


Figure 3. Line graph of self-compassion as a moderator of pain intensity and the mean physical component of quality of life, controlling for annual household income.

CHAPTER IV

DISCUSSION

Review of Findings and Implications

The goal of this study was to show supporting evidence for the role of self-compassion in promoting positive emotion in those with chronic pain. Previous empirical findings suggest that higher positive emotion is important because it is linked with reduced pain, lower negative emotion and promotes improved well-being and resilience over time through various mechanisms proposed in the broaden-and-build theory (Frederickson et al., 2001). However, per the dynamic model of affect (Zautra et al., 2001), those with chronic pain have a hard time experiencing positive emotion because when they experience a chronic stressor like pain, negative emotion tends to overshadow positive experiences and is the dominant experience of emotions. Ultimately, this experience of lower positive emotion and higher negative emotion will lead to more pain given previous research on the relationship between emotion and pain, thus creating a negative feedback loop of high negative emotion, low positive emotion and high pain, that can also create a cascade of deleterious effects on levels of functioning such as disability and quality of life. The findings of this study demonstrated the role that self-compassion can have in disrupting this cycle. Overall, self-compassion was associated with significantly higher positive emotion, lower negative emotion, lower pain, lower pain disability, higher mental QoL and marginally insignificant physical QoL (Aim 1).

Further, self-compassion contributed unique and significant variance to changes in positive emotion, negative emotion, pain disability and mental QoL in those with chronic pain, independent of related factors, mindfulness and pain acceptance and covariates (Aim 3). Even more compelling is that when examining whether self-compassion moderated the relationship between pain severity and positive emotion, self-compassion accounted for the majority of significant change in positive emotions as opposed to pain severity, demonstrating the potential ability for it to weaken the negative relationship between pain severity and positive affect at all levels of self-compassion. Further, high levels of self-compassion were able to attenuate increasing negative emotion even when pain was high by significantly moderating the relationship between these two variables. Specifically, over the last week, those who reported higher pain did not show higher rates of negative affect if they were also high in self-compassion. Further, self-compassion had significant effects on physical QoL even when pain was high (Exploratory Aim). Overall, these findings suggest the unique, protective role that self-compassion has in relation to influencing positive and negative emotion simultaneously in those with chronic pain, which research suggests could ultimately affect the trajectory of further suffering, such as more pain, disability and poor quality of life. Specific findings from the study in addition to this overview are presented below.

Interpretation of Main Findings

Hypothesis 1. *Self-compassion will be significantly positively associated with positive emotion/affect, and significantly negatively associated with negative emotion/affect, pain severity, disability and quality of life.*

Results from Pearson bivariate and Spearman's rho correlations supported this hypothesis. Specifically, self-compassion was found to be positively correlated with positive affect and negatively correlated with negative affect, consistent with previous literature in samples without chronic pain (e.g. Neff, Rude & Kirkpatrick, 2007 for positive affect; Choi, Lee & Lee, 2014 for negative affect). These findings are also consistent with the only other study examining these relationships in a sample with chronic pain (Wren et al., 2012). However, this study also contributed novel findings to the literature by finding significant relationships between higher self-compassion and lower pain severity, as well as higher quality of life, and demonstrating significant relationships with a novel measure of positive and negative emotion, the mDES. Thus, these findings contribute to the paucity of research examining self-compassion in relation to relevant outcomes in those with chronic pain.

Hypothesis 2: Using the modified Differential Emotions Scale (mDES), positive emotion/affect will be more strongly positively associated with self-compassion than positive emotion as measured by the PANAS, and there will still be a significant relationship between the mDES and Self-Compassion Scale even when affect as measured by the PANAS is controlled for.

Results from Pearson bivariate correlations supported this hypothesis. Specifically, results indicated that while both measures of positive emotion were significantly correlated with self-compassion, positive emotions as measured by the mDES were more significantly correlated with self-compassion than positive emotions measured by the PANAS. This result remained even when positive emotion as measured by the PANAS was controlled for, indicating that there is still a significant and unique

relationship between positive emotion as measured by the mDES and self-compassion that is not overlapping with positive emotion measured by the PANAS. These findings are an important contribution to the literature as no other study has explored the relationship with self-compassion and another self-report measure of positive emotion that did not use the PANAS. Further, no other study has compared the relative relationships between two measures of positive emotion in a sample with chronic pain. These findings are consistent with the argument that the mDES may capture more positive emotion words consistent with the construct of self-compassion than the PANAS, and may at least partially explain the underrepresentation of more significant findings between these two constructs in previous literature. Thus, this establishes a rationale for further exploration of alternative measures of positive emotion in studies examining self-compassion.

Hypothesis 3a. Self-compassion would predict significant and unique variance in positive emotion/affect, in addition to mindfulness and acceptance.

Results from hierarchical regression analyses supported this hypothesis. Specifically, self-compassion was found to be a significant and unique predictor in positive emotion independent of gender, income level, mindfulness and pain acceptance. Further, in this full model, self-compassion and pain acceptance were the only significant predictors. Post-hoc analyses demonstrated that the activity engagement subscale was driving the relationship between pain acceptance and positive emotion, which is consistent with previous research on ACT (Kranz, Bollinger and Nilges, 2010). These findings are not surprising, considering activity engagement and behavioral activation

have been linked to increases in positive mood across research studies (e.g. Jacobson, Martell & Dimidjian, 2001; Mageau & Vallerand, 2007).

Interestingly, the amount of variance contributed by self-compassion to positive emotion (6.3%) was comparable to the one and only other study exploring this relationship in a chronic pain sample (7%; Wren et al., 2012); however, that study only controlled for demographic variables and not contributions from mindfulness and acceptance. This is important because of the interconnected relationships between self-compassion, mindfulness and acceptance between theoretically and empirically, and yet self-compassion still had unique and significant contributions to outcomes in positive emotion in a chronic pain sample similar to previous findings. Further, given that the study by Wren and colleagues (2012) did not examine these constructs in the same model, the variance contributed by self-compassion to changes in positive affect may have been higher in this study if only controlling for demographic variables. In fact, post-hoc exploratory analyses examining hierarchical linear regression with self-compassion and only the covariates of gender and income level found that self-compassion contributed 25.9% of significant and unique variance in changes in positive emotion (as measured by the mDES) independent of age and gender, compared to 18.3% of unique variance in changes in positive emotion as measured by the PANAS. It's important to note that the study by Wren and colleagues (2012) used the PANAS, and they also controlled for other demographic variables not including in this study's regression model, including ethnicity, partner status, and financial compensation for pain, which may have contributed to the lower variance contributed by self-compassion to positive emotion in their model. Nonetheless, the higher variance contributed by self-compassion to changes

in positive emotion is at least partially due to using the mDES over the PANAS. Thus, these findings further support the notion that the positive emotion scale of the mDES may be better utilized in determining significant relationships in studies examining self-compassion.

Further, the results from this analysis support the notion that self-compassion is a unique and significant predictor of change in positive emotion, independent of sociodemographic variables of income level, gender and similar but disparate correlates, mindfulness and acceptance. This is important given the literature on the role of positive emotion as source of resilience in those with chronic pain as discussed previously, and the need with which finding diverse and unique positive emotion-promoting strategies are in a population where positive emotion may be difficult to access.

Hypothesis 3b. Self-compassion would predict significant and unique variance in negative emotion/affect, in addition to mindfulness and acceptance.

Results from hierarchical regression analyses supported this hypothesis. Specifically, self-compassion was found to be a significant and unique predictor in negative affect independent of gender, income level, mindfulness and pain acceptance. This finding was also comparable to the only other study comparing these variables in a chronic pain sample (Wren et al., 2012), where self-compassion contributed to 14.2% of variance in negative affect beyond mindfulness, acceptance, income level and age, compared to 15% in the study by Wren and colleagues (2012). Self-compassion was also the only significant predictor in this five-predictor model. However, in the model that included age as a covariate, age was also a significant predictor and self-compassion's

contribution to the variance in negative affect was 11.6%, which is still relatively comparable to the findings from Wren and colleagues (2012). However, as previously mentioned, the study by Wren and colleagues (2012) did not compare self-compassion in a model including mindfulness and acceptance, and thus the variance contributed by self-compassion in negative affect when only controlling for demographic variables may have been higher in this sample. In fact, post-hoc exploratory analyses examining hierarchical linear regression with self-compassion and covariates of gender, income level and age found that self-compassion contributed 25.9% of significant and unique variance in changes in negative emotion independent of these demographic variables. Again, it's important to keep in mind that the study by Wren and colleagues (2012) controlled for other demographic variables as well which may have lowered the overall contributions to variance made by self-compassion to negative affect in their study.

Regardless, this finding suggests that self-compassion is a significant and unique predictor of changes in negative emotion in a model compared with mindfulness, acceptance and demographic variables. Interestingly, the amount of variance contributed by self-compassion to negative emotion is more than double than was contributed to positive emotion, even when also including age in this hypothesis' analysis. Further, self-compassion was the only significant predictor when compared to mindfulness and acceptance. This finding is not surprising given the inherent definition of self-compassion, as a means of gently soothing one's suffering or otherwise negative experiences, which includes negative emotion (Neff, 2003).

Hypothesis 4a. Self-compassion would predict significant and unique variance in pain severity, in addition to mindfulness and acceptance.

Findings from this analysis demonstrated that in a model that included self-compassion, pain acceptance, mindfulness, and covariates, gender and income, that income level was the only significant predictor of pain severity. This finding is not surprising as individuals from lower income backgrounds are more likely to face more deleterious mental and physical health outcomes overall (Schultz, 1993). It is possible that mindfulness, self-compassion nor pain acceptance were able to exert a strong enough effect beyond income level for this outcome.

Hypothesis 4b. Self-compassion would predict significant and unique variance in pain disability, in addition to mindfulness and acceptance.

Findings from this analysis supported this hypothesis. Specifically, these analyses demonstrated that self-compassion was a significant and unique predictor of changes in pain disability independent of mindfulness, acceptance and demographic covariate variables (age and income level). Specifically, self-compassion and the overall variable of pain acceptance were the only significant predictors in this full model. This is consistent with findings from Wren and colleagues (2012) who found that higher self-compassion was associated with lower pain disability as well. Further, pain acceptance is also associated with lower disability across self-report studies (McCracken & Eccleston, 2003) and intervention studies examining ACT, which includes acceptance as a mechanism of change (Dahl, Wilson & Nilson, 2004). Further, pain acceptance and self-compassion were also the only significant predictors of positive emotion. Previous research has demonstrated an interconnected relationship between self-compassion and pain acceptance (Costa & Pinto-Gouveia, 2011) where each influence and potentially reinforce the other, or uniquely explain mechanisms of change in ACT (Vowles et al.,

2014). Thus, the combination of these two variables may be able to contribute to even greater changes in positive emotion and improved functioning such as lower disability.

Hypothesis 4c. Self-compassion would predict significant and unique variance in quality of life, in addition to mindfulness and acceptance.

Findings from this analysis partially supported this hypothesis. Specifically, these analyses demonstrated that self-compassion was a significant and unique predictor of change in the mental component of quality of life when compared to mindfulness, acceptance, age and gender, but not the physical component. In terms of mental QoL, self-compassion and the activity engagement domain of pain acceptance were the only significant predictors. This is consistent with the multiple regression findings with positive emotion, suggesting there may be some similarities with positive emotion and the mental component of quality of life. For the physical component of QoL, only income level and overall pain acceptance were significant predictors of change.

Interestingly, income level was only a significant predictor in changes in pain severity and physical component of QoL. As mentioned before, individuals from low income backgrounds are generally more likely to experience poor mental and physical health outcomes (Yoshikawa, Aber, & Beardslee, 2012), and this includes individuals with chronic pain (Fuentes, Hart-Johnson, & Green, 2007). It may be the case that self-compassion and pain acceptance are able to buffer more against outcomes related to mental and social health, including positive and negative emotion, the mental component of QoL (which includes social domains), and pain disability (which also includes social and mental domains), rather than physical health outcomes, which include the measures

of pain severity and physical QoL. This is not surprising, since the goals of both self-compassion and pain acceptance, or acceptance in general, are not to change the original experience (e.g. physical pain, immobility), but to ameliorate the secondary suffering that can stem from these experiences, including poor mood or social withdrawal and isolation (Hayes, Strosahl, & Wilson, 2011). In fact, much of the research on self-compassion, as well as pain acceptance, has demonstrated some significant effects on physical health outcomes, but more robust effects have been found with the mental health aspects of functioning, such as emotional regulation and mental well-being (e.g. Viane, Crombez, Eccleston et al., 2003; Veehof, Trompetter, Bohlmeijer & Schreurs, 2016; Neff & Knox, 2016).

Hypothesis 5a. The interaction between pain severity and self-compassion would predict statistically significant variance in positive emotion/affect. Specifically, self-compassion will significantly moderate the relationship between pain severity and positive affect, such that higher self-compassion will attenuate the effect of pain severity on decreasing positive affect, even when pain severity is high.

Pain severity and positive affect have consistently been found to have an inverse relationship both in the literature and in the current study, which is also consistent with the dynamic model of affect (Zautra et al., 2001). It was proposed that higher self-compassion would moderate the relationship between pain severity and positive emotion, by attenuating reductions in positive emotion as pain increased. The results did not support this hypothesis. However, examining individual predictors in the model revealed that self-compassion accounted for the majority of significant changes in positive emotion; in other words, when self-compassion was added to the regression model, pain

severity was no longer a significant predictor of changes in positive emotion. Moderation analyses were consistent with this finding, revealing that the relationship between pain severity and positive emotion was insignificant at all levels of self-compassion. Thus, self-compassion has a greater effect on changes in positive emotion than pain severity at all levels of self-compassion. This is consistent with the theory behind how self-compassion works; Germer and Neff (2013) suggests that positive emotions are able to be generated by embracing suffering, such as pain, with kindness, gentleness and warmth. Also as indicated previously, self-compassion has consistently been associated with more positive emotions and related variables such as happiness (Hollis-Walker & Colosimo, 2011). This is important, given that higher pain has been shown to lead to reductions in positive emotion, self-compassion can allow one to meet these negative experiences with positive emotions such as self-kindness and warmth, thus generating positive emotion as a response to suffering.

Hypothesis 5b. The interaction between pain severity and self-compassion would predict statistically significant variance in negative emotion/affect. Specifically, self-compassion would significantly moderate the relationship between pain severity and negative affect, such that higher self-compassion would attenuate the effect of pain severity on increasing negative affect, even when pain is high.

Pain severity and negative emotion have also been shown to have a significant positive relationship in the literature and current study. It was hypothesized that higher levels of self-compassion would moderate the relationship between pain severity and negative affect. Results supported this hypothesis when the two outliers were removed, such that there was a significant, negative relationship between pain severity and negative

affect at low and average levels of self-compassion, but at high levels of self-compassion, the relationship between pain severity and negative affect became non-significant, suggesting the attenuating effects that high self-compassion can have on pain in how it influences negative affect, particularly when pain severity is high. This has important ramifications given research findings related to the dynamic model of affect (Zautra et al., 2001) which has found that under high levels of stress such as chronic pain, attentional resources becomes overwhelmed by the stressor, allowing negative emotion to thrive as opposed to the ability to experience a full range of emotions. This finding suggests that high self-compassion may break the interdependent relationship of higher pain and negative emotion, potentially putting the individual in a state similar to those under low stress, where positive and negative emotion are less related and can be experienced concurrently (Zautra et al., 2001). Research on self-compassion supports this notion as well, where self-compassion has been shown to be associated with lower negative affect in response to a stress induction task. In the same study, those with higher self-compassion showed higher heart rate variability (HRV) in response to the stress task, a biological marker of stress regulation (Luo, Qiao, & Che, 2018). Similar findings have also been found for self-compassion being associated with lower stress response as measured by salivary alpha-amylase (Brienes, 2015). Thus, self-compassion may dampen the effect of pain severity on increasing negative affect through its reduction in stress.

However, another potential explanation for how self-compassion is attenuating negative emotion during the experience of high pain, and also accounting for more significant changes in positive emotion independent of pain severity (per Hypothesis 5a) is through emotional regulation. Emotional regulation refers to cognitive and automatic

strategies individuals employ that influence intensity, duration and expression of emotional states, particularly negative emotion (Gratz & Roemer, 2004). Maladaptive strategies to regulate negative emotions include avoidance, rumination, or substance use (Gratz & Roemer, 2004). While these strategies may reduce stress in the short-term, in the long-term they contribute to increased negative emotional states as well as cognitive, physiological and behavioral dysregulation that can worsen mental and physical health (Gratz & Roemer, 2004). Diedrich and colleagues (2017) found that self-compassion was associated with increased ability to tolerate negative emotions, an emotion regulation skill, in those with depression (Diedrich, Burger, Kirchner, et al., 2017). This may be due to the inherent qualities of self-compassion bringing a kinder and gentler attitude to suffering that may make negative emotions feel more manageable and enable them to be processed as opposed to avoided. However, it may also be through the generation of positive emotions of kindness and warmth that negative emotions may feel more manageable (Diedrich et al., 2017).

Hypothesis 6a-b. The interaction between pain severity and self-compassion would predict statistically significant variance in functional outcomes, a) pain disability and b) quality of life. Specifically, self-compassion would significantly moderate the relationship between pain severity and functional outcomes by a) attenuating pain severity's effect on increasing pain disability and b) attenuating pain severity's effect on reducing quality of life; even when pain severity is high.

Contrary to predictions, self-compassion did not significantly moderate the relationship between pain severity and pain disability or with the mental component of quality of life (QoL). The covariate, income level, was not a significant predictor in either

of these analyses and thus did not account for this finding. Further, given that pain acceptance was also a significant predictor of pain disability and mental QoL in hypothesis 4b and 4c, moderation analyses also explored whether pain acceptance would moderate the relationship. Results from these analyses were also insignificant. Given that this hypothesis was exploratory in nature and no previous research studies have examined this relationship, the results suggest that self-compassion and pain severity each significantly influence pain disability and mental QoL, but that the relationship between pain severity and these variables does not change at different levels of self-compassion (see Table 21 and 22 for detailed results.)

Interestingly, self-compassion did significantly moderate the relationship between pain severity and the physical component of quality of life (QoL), but in a way that was not predicted. Specifically, when self-compassion was low, physical QoL was high when pain severity was high. As self-compassion got higher, this relationship reversed, such that high levels of self-compassion were associated with lower levels of physical QoL even when pain severity was high. When examining the individual items of the physical QoL subscale, items included whether one's health was limiting activities such as "climbing several flights of stairs" or whether pain interfered with normal work at home or housework. This finding could be explained by the tendency for self-compassion to be related to being more kind to one self (Neff, 2003a) and thus, if pain severity is high, one may be not as likely to push themselves to be physically active in ways that could harm oneself. Contrarily, if self-compassion is low, one might be more like to be self-critical (Neff, 2003a) and thus be more likely to push oneself physically in ways that could ultimately be physically or mentally harmful when pain severity is high. A research study

by Magnus, Kowalski, & McHugh (2010) conducted a study in women exercisers and found a similar pattern of results related to the current study's findings, where self-compassion was negatively related to obligatory exercise behavior, which is characterized by the tendency to exercise in ways that are harmful to one's physical or psychological well-being (Steffen & Brehm, 1999). Combined with the findings that self-compassion is related to lower negative affect even when pain severity is high and overall protects against pain severity's deleterious effects on positive emotion, self-compassion may be protective for individuals with physical limitations such as chronic pain by promoting patience with one's physical limitations concurrently with an adaptive emotional outlook.

Strengths of the Current Study

One strength of this research study is that it was conducted in an educationally and socioeconomically marginalized population that was also relatively diverse in terms of gender, ethnicity, and race. Furthermore, self-compassion and pain acceptance were found to be beneficial for a number of the outcomes measured, predicting significant unique variance in negative and positive affect, pain severity, pain disability and quality of life in this sample. This has major implications in terms of our understanding of how these resilience factors function in more heterogeneous samples, such as those with chronic pain, given that a majority of the research conducted using self-compassion and other mindfulness and acceptance-based self-report measures or interventions broadly are conducted in relatively homogeneous samples in terms of these areas of diversity, with participants who are predominantly female, middle to upper class in socioeconomic status, college-educated, or Caucasian (Davidson & Kaszniak, 2015). Secondly, this study expands our limited understanding of how individuals from different ethnoracial

and socioeconomic backgrounds may receive and benefit from these coping strategies and interventions. It's important to also note that outliers found in the sample tended to be working full-time, make an annual combined household income of \$100,000 a year or more, and/or have a Bachelor's degree or higher. Given that the majority of the sample were disabled or retired, had an annual combined income of between \$5,000-\$19,000 and some college education or less, these outliers were removed from final analyses when patterns of results were changed as a result of them not representing the majority of the sample. A unique aspect of the current study was demonstrating significant effects of self-compassion in a sample that represented a socioeconomically and educationally marginalized population, and thus removing outliers consistent with this pattern of demographics in future studies may demonstrate more robust effects for self-compassion in a population with chronic pain that has been largely understudied with compassion and acceptance-based interventions. Overall, given the high healthcare utilization and limited financial resources in the majority of the sample, this study establishes a foundation for the potential utility of compassion or acceptance-focused interventions in a population who are in high need of lower cost, accessible and effective interventions that can reduce the overall healthcare utilization of chronic pain patients.

Another strength is that findings from the current study support that self-compassion holds promise as a unique and significant resilience factor in those with chronic pain, independent of mindfulness and acceptance. Given the complex nature of chronic pain and the number of individual factors which determine how chronic pain is experienced from person to person, expanding our knowledge of resilience factors that can promote mental and physical well-being in those with chronic pain is essential.

Furthermore, a number of research studies have demonstrated the numerous benefits of third-wave behavioral therapies, including MBSR and ACT, in those with chronic pain. This is particularly important when research has also supported that self-compassion is an active mechanism of change in a number of these interventions (e.g. Birnie, Speca, & Carlson, 2010; Yadavaia, Hayes & Vilardaga, 2014). By demonstrating that self-compassion makes its own unique and significant contributions to important outcomes in chronic pain, it suggests that further research on the role that self-compassion has in these empirical interventions would be warranted. Additionally, findings in the current study also supports the rationale for further research on specific compassion-focused interventions, such as the Mindfulness-based Self-compassion (MSC) program, and its applications to samples with chronic pain.

Limitations and Future Directions

One limitation of the current study is that it was cross-sectional in nature and thus causality between variables could not be determined. This is particularly important given findings on positive and negative affect in relation to self-compassion. Research has illustrated the complex relationship between positive and negative affect in terms of their temporal relationships, and thus our understanding of the role of self-compassion in terms of the temporal influence it has on these factors is limited by the current study. Future research measuring daily positive and negative affect as a function of changes in self-compassion can better help to elucidate the process by which self-compassion may be affecting negative and positive affect temporally and determining whether these effects are occurring concurrently, in succession, independently or interdependently, and under what conditions. Further, understanding these relationships in the context of changes in

pain severity can also further elucidate these complex temporal relationships. Utilizing ecological momentary assessment studies (Shiffman, Stone, & Hufford, 2008) and other longitudinal design models can better clarify the true nature of self-compassion's role on these variables across time. Relatedly, given previous literature, it was proposed that self-compassion may be influencing positive and negative affect through reductions in stress that may be allowing one to experience a full range of emotions per the Dynamic Model of Affect (Zautra et al., 2001). While research has supported the role of self-compassion in regulating stress responses (e.g. Breines, 2015), establishing this mechanism of change in samples with chronic pain would need to be addressed. Further, there may be other mechanisms by which self-compassion is affecting emotions, particularly negative emotions, such as previously discussed emotional regulation (Diedrich et al., 2017). Future research utilizing longitudinal studies in individuals with chronic pain are warranted, as they can better clarify these potential mechanisms of change, such as lowering stress, emotional regulation or potential other mechanisms of change by which self-compassion is influencing emotion or other aspects of adaptive functioning.

Secondly, while the cross-sectional nature of the study helps to establish associative relationships between self-compassion, mindfulness, pain acceptance and the dependent variables, future studies utilizing experimental designs or interventions would be better able to determine causality with these variables as well. Further, this study only demonstrates the benefits that self-compassion has in individuals who already have some level of self-compassion. Thus, future research administering interventions designed to teach self-compassion to those without high levels of self-compassion would be useful to determine whether self-compassion can be taught and increased in those with chronic

pain who don't already have high levels of it, and to determine whether increases in self-compassion from an intervention can lead to similar benefits found in the current study, such as increases in positive emotion, decreases in negative emotion, and improve pain disability and mental QoL. Even more useful would be to conduct intervention studies on mindfulness and acceptance-based therapies, such as MBSR or ACT, or more compassion-focused interventions such as MSC or CFT; then, measuring self-compassion, mindfulness and pain acceptance before and after, as well as pre and post measures of positive and negative emotion, pain severity and disability, quality of life, or other functional outcomes, to determine what is accounting for the change in these variables as a function of these interventions. These types of studies can expand on the multiple regression analyses conducted in the current study to help us understand how clinical applications of mindfulness and acceptance-based interventions or compassion-focused interventions are working in populations with chronic pain and which active ingredients are changing different outcomes. This is particularly important given the complex nature of individuals with chronic pain and determining different change agents that can address the unique and complex needs of this population. Further, given that a majority of patients with chronic pain are treated in primary care settings or tertiary pain clinics, determining brief intervention tools that are valid representations of these ingredients would be beneficial. For example, the Mindful Self-Compassion (MSC) program is an 8-week program with diverse, guided practices and exercises for teaching self-compassion, and yet would be impractical to implement the full protocol in most primary and tertiary care settings. Thus, conducting studies that implement the practices and exercises individually from full protocols such as MSC, as well as measuring self-

reported self-compassion, emotion, pain and other aspects of functioning following their implementation, could be useful in determining whether findings on the benefits of self-compassion for chronic pain have ecological validity as well.

Another limitation to consider is the current study's measure of pain. While the Numerical Rating Scale has been consistently found to be brief and easy to use across samples, it is limited by its ability to measure only one domain of pain, specifically pain intensity, which is most consistent with the sensory-discriminate aspect of pain (Melzack & Casey, 1967). Given that chronic pain is a multidimensional experience, other pain measure include assessment of the affective-motivational and cognitive-evaluative domains of pain, such as the McGill Pain Questionnaire (Melzack, 1975). While the current study measured overall positive and negative emotion experienced over the last week, it would be useful for future studies to explore these broader measurements of pain in comparison to overall measures of emotion. This could help elucidate the variance contributed by the affective components of the pain experience specifically in relation to overall positive and negative emotion in the last week. Clarifying contributions from pain and other sources on an individual's emotional experience could help further inform mechanisms of change in emotions as well as tailoring individual treatment.

Another potential limitation to consider is the current study's measurement of self-compassion. While the Self-Compassion Scale (Neff, 2003a) is the most empirically supported measure of self-compassion in the literature, it is derived from a construct of self-compassion that includes theoretical elements, such as common humanity and mindfulness, which some argue may not necessarily be considered critical components of self-compassion (Gilbert, 2014). Further, this measure of self-compassion excludes other

proposed key elements of self-compassion, such as the motivation and intention to alleviate suffering (Gilbert, 2014). Future studies should further examine this measurement of self-compassion and consider potentially related concepts not inherent to the current conceptualization in the SCS, but that may be as relevant to the overall conceptualization of self-compassion, examining components of self-compassion that may be most relevant and useful in a sample with chronic pain. Further, examining other components of self-compassion through measurement may reveal more significant or unique relationships with positive and negative emotion and other study variables not demonstrated in the current results in future studies on samples with chronic pain, and potentially improving our understanding of how these variables function in this population.

Another potential limitation of the current study was the limited significant findings with mindfulness. While mindfulness was found to have significant correlations with a number of variables in the study, correlations between these variables and self-compassion and pain acceptance tended to be higher, and mindfulness was not a significant predictor in any of the analyses when compared to pain acceptance and self-compassion. Given that there are no studies to date that have compared mindfulness, self-compassion and pain acceptance in a chronic pain sample, it is possible that mindfulness may not be as relevant in this population when compared to these other two variables. Limited findings may have been due in part to the restricted variability in scores on the MAAS. With a score range of 1-6, the mean score of the sample was 4.26, with a standard deviation of .73, suggesting scores were significantly clustered on the higher end of mindfulness. Related to this, limited findings may also be due to issues in how

mindfulness was measured. While the Mindful Attention Awareness Scale (MAAS) has been found to be a valid measure in chronic pain samples (McCracken, Gauntlett-Gilbert, & Vowles, 2007) and predicts outcomes that are consistent with mindfulness theory (MacKillop & Anderson, 2007), the MAAS relies exclusively on negatively formulated items which may have led to interpretation issues in the current sample that led to higher reporting of mindfulness, despite the inclusion of attention checks throughout the measure. Further, mindfulness measures in general tend to come with a number of psychometric limitations. For example, studies on mindfulness measures overall, including the MAAS, have been critiqued for the paucity of qualitative methods to confirm that participants understand questions and their relevance (Park, Reilly-Spong, & Gross, 2013). Additionally, measures of test-retest reliability are lacking (Park et al., 2013). Additionally, each of the current mindfulness scales provide a different description of what mindfulness is (Christopher, Christopher, & Charoensuk, 2009). Some measures, such as the MAAS, have been critiqued for conceiving of mindfulness too narrowly (e.g. focusing primarily on the attention and awareness components) and thus being limited in content validity, which may have also resulted in the limited contributions of mindfulness in the current study. However, other more comprehensive mindfulness measures, such as the Five Facet Mindfulness Questionnaire (FFMQ; Baer, Smith & Hopkins, 2006), while broader in scope, may be the same reason why it has been critiqued for issues related to discriminant validity and measuring theoretically unrelated constructs to mindfulness (Goldberg, Wielgosz, Dahl, et al., 2016). Even in the current study, the MAAS and Mindfulness subscale of the SCS are uncorrelated ($r=.05$, $p=.64$), further highlighting how different mindfulness scales may be measuring different

aspects of mindfulness. These issues with mindfulness measures have actually been part of a larger criticism utilizing self-report measures of mindfulness, specifically with whether individuals can accurately self-report mindfulness in general. Grossman (2008, 2011) has suggested there are individual differences in mindfulness self-report due to response bias, individual differences related to culture or meditation experience, and semantic understanding. While accuracy, response bias and cultural differences can be a potential issue with self-report measures in general (Beaton, Bombardier, Guillemin, et al. 2000; Van de Mortel, 2008), one unique issue with mindfulness measures is that one may require a certain level of mindfulness capacity in order to accurately self-report their level of mindfulness (Grossman, 2011). For example, being able to accurately report how well one is paying attention in the present would require some attention to the present moment (Grossman, 2011). Thus, improving our operationalization of mindfulness as it pertains to self-report measure, including semantically and unambiguous items, evaluating participant understanding of included items across individuals with different individual backgrounds (e.g. meditators versus non-meditators), removing items that cannot be self-evaluated, or co-administering self-report measures with experimental paradigms that may be able to better quantify latent mindfulness-based constructs (e.g. attention-based computer tasks), could all improve the validity of self-report mindfulness measures in future research with individuals with chronic pain.

Another limitation is the scope of exploration of variables in the current study in relation to self-compassion. Exploring positive emotion in the context of chronic pain highlights a broader shift from focusing exclusively on vulnerabilities in chronic pain towards understanding how some individuals with chronic pain are resilient despite their

pain, and whether resilience can be taught (Sturgeon & Zautra, 2010; Sturgeon & Zautra, 2016). Positive emotion has been proposed as a significant source of resilience for individuals with chronic pain and was a major focus of the current study, but it is one of many that have been linked to resilience in this population, including both individual factors (e.g. optimism, acceptance) and social factors (e.g. strong social connections; Sturgeon & Zautra, 2016). Indeed, findings from the current study suggests self-compassion's potential role in affecting a much larger resilience network than just positive emotion alone, including negative emotion, pain disability and mental QoL. However, this is only a snapshot of the number of variables that self-compassion may be beneficial for in those with chronic pain. For example, negative emotion is one aspect of depression and anxiety, which also include cognitive and behavioral components of functioning. Given needs to balance between exploring multiple variables of interest and maintaining enough power and effect size in the current study given the sample size, this study explored one aspect of depression and anxiety, specifically emotion, considering its significant relationship with chronic pain in the theoretical and empirical literature and influence on functioning. However, future studies examining self-reported depression or anxiety using measures such as the Beck Depression Inventory (BDI; Beck et al., 1961) or Beck Anxiety Inventory (BAI; Beck & Steer, 1993) may give us more information on the different cognitive and behavioral domains of functioning that self-compassion may influence in addition to emotional domains. Further, self-compassion may be particularly beneficial for some aspects of functioning more than others. For example, some qualitative studies suggest that many individuals with chronic pain report high feelings of shame, self-blame or worthlessness as a result of their chronic pain, particularly in those

with no known etiological cause or certain types of pain, such as pelvic or genital pain (Werner, Isaksen, & Malterud, 2004; Stone, 2014). Self-compassion has been associated with fostering improvements with these types of negative self-conscious emotions, as indicated in Compassion Focused Therapy (CFT; Gilbert, 2009) and self-report studies in clinical (Ferreria, Pinto-Gouveia & Duarte, 2013) and non-clinical samples (Woods & Proeve, 2014). Individuals with high shame and related difficulties may have trouble with self-compassion which is potentially directly related to the fact that they are low in it, and thus may need it even more. Future studies should explore other individual factors that self-compassion may affect in order to determine other subpopulations who may benefit and expand our understanding of the range of benefits self-compassion may offer in this population. This could also help to inform tailoring interventions to subpopulations of individuals with chronic pain based on individual differences and needs.

Conclusion

Overall, there is some debate in the literature regarding the role of negative and positive emotion in adaptive functioning in chronic pain patients (Lumley et al., 2011). In fact, research suggests that trying to control, suppress or reduce negative emotion can actually be counterproductive in adaptive functioning in chronic pain, as evidenced by literature on the role of experiential avoidance in predicting more negative pain outcomes (Costa & Pinto-Gouveia, 2013). However, research in the area of emotion and chronic pain has been experiencing a paradigm shift, in that rather than focusing on negative emotion and how to control it, attention has been drawn to the benefits of promoting positive emotion. The potential promise of self-compassion is a reconciliation of both of these two areas of research. Self-compassion can be seen as an emotion regulation

strategy, in which painful feelings are not avoided or controlled in some way, but are instead held in awareness with kindness, understanding, warmth, a sense of shared humanity and balanced awareness. It may also go one step further than other strategies that are associated with increased positive emotion, because of how it directly and actively addresses negative emotion. In fact, many of the empirical studies on self-compassion and results from the current study demonstrated significant relationships between higher self-compassion and reduced negative emotion. Self-compassion is concerned with attending to feelings such as inadequacy and sense of failure with a sense of kindness and understanding that negative feelings are not experienced in isolation (Neff, 2003a). Thus, by employing self-compassion, negative emotions could be transformed into more positive feelings, so that negative emotions can be held with kindness and common humanity. Ultimately, self-compassion may allow for space in which positive emotions can be cultivated, the negative emotion that typically accompanies chronic pain can be dampened and ultimately, more adaptive functioning can be achieved (Neff, 2003a). Pursuing future interventional studies to explore the role that self-compassion has in addressing negative and positive emotion in those with chronic pain, as well as other correlates of adaptive functioning, can help to elucidate this complex relationship temporally and understand more about interventions that can be uniquely tailored and applied to the various complexities that those with chronic pain face.

Further, adding to the literature on sources of resilience that can be promoted and enhanced in this population has critical implications for the future of treatment in chronic pain. Resilience is the ability to demonstrate “effective functioning despite the exposure

to stressful circumstances and/or internal distress”, such as chronic pain (Karoly & Ruehlman, 2006; Sturgeon & Zautra, 2010). Resilient individuals with chronic pain have been described in various ways in the literature, including experiencing lower negative aspects of functioning, such as lower cognitive and emotional burden despite the experience of pain (e.g. lower pain catastrophizing; adaptive emotional regulation) and lower disability from pain (Goubert & Trompetter, 2017). Simultaneously, resilient individuals with chronic pain experience more positive outcomes, including engagement in values-based activities, psychological well-being, and social engagement despite the presence of pain (Goubert & Trompetter, 2017). Given that those with chronic pain, particularly those from disadvantaged sociodemographic backgrounds, continue to face mental and physical health disparities that stem from barriers to care, access to resources, poor treatment management or delays to adequate treatment, including opioid dependence, this study highlights the necessity for continuing to grow our understanding of ways to buffer against negative aspects of functioning while simultaneously promoting sustainable, positive aspects of functioning in those with chronic pain than can create enduring resilience in this population. Enhancing resilience in those with chronic pain can also foster a sense of self-efficacy and control in the self-management of their pain vital to the long-term adaptive functioning and well-being of this population and can improve interventions and overall quality of care provided by healthcare professionals caring for these individuals.

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Table 1. Relevant studies demonstrating effects of positive emotion/affect in individuals with chronic pain.

Citation	Sample	Pain Measure	Affect Measure	Relevant Findings
Finan, Quartana & Smith (2013)	151 adults with chronic knee osteoarthritis pain (48 men, 103 women); subpopulation of participants (n=79) also participated in lab measures	Self-reported daily pain on VAS ³ and clinical assessment of knee OA using pain subscale of WOMAC ⁶ ; subpopulation (n=79) underwent QST ⁷	Items taken from PANAS-X ⁴ and POMS-Bipolar ⁵ (state)	Using multilevel modeling, increases in daily state PA relative to the mean were associated with pain reduction ($t(1585) = -4.75, p < .001$) even when NA was added as a covariate ($t(1581) = -3.58, p < .001$). Daily variations in state NA that were higher than the mean was associated with higher pain, but this relationship was attenuated to non-significance when PA was added as a covariate ($t(1564) = 1.83, p = .068$). In the subpopulation, state PA significantly predicted lower mechanical phasic pain ($t(76) = -20, p = .042, R^2 = 0.08$).
Gil, Carson, Porter, et al. (2004)	41 African American adults with sickle-cell disease (SCD); 23 women, 18 men	Average daily pain level reported on VAS ³	Daily Mood Scale ² (state)	Multilevel random effects analysis showed positive mood significantly predicted lower same day ($t = 27.94, p < .0001$) and pain two days later ($t = -3.27, p < .001$).

Ong, Zautra, Reid (2010)	95 participants with non-malignant chronic pain (72 women, 23 men)	Self-reported daily pain intensity level (0-10)	Self-reported daily positive and negative emotions (12 items each) rated on 1-5 scale (state)	Significant negative correlation between positive emotions and pain intensity ($r=-.29, p<.01$). Reports of positive emotion associated with .19 unit reduction in pain catastrophizing the next day ($SE=.02, p<.01$), with gender significantly moderating the effect ($b=-.25, SE=.05, p<.001$). Proportion of indirect effect of positive emotion on the change between psychological resilience (E-RS ⁸) and pain catastrophizing was .44.
Potter, Zautra & Reich (2000)	female patients with rheumatoid arthritis (n=41) and fibromyalgia (n=112)	Self-report VAS ³	PANAS ¹ ; measure taken from fibromyalgia patients at one time point; weekly assessment averaged across 33 weeks from RA patients (trait)	Higher trait positive affect associated with significantly less pain in the patients with rheumatoid arthritis during high stress weeks ($r = -.596, p < .001$). Higher reported state positive affect associated with significantly less pain in the patients with fibromyalgia ($r = -.186, p = .049$).
Strand, Zautra, Thoresen, et al. (2006)	Female patients with rheumatoid arthritis (n=43)	Self-reported weekly pain (scale 0-10)	Weekly measure using PANAS (state)	Multilevel regression indicated higher weekly PA predicted lower weekly NA during high pain weeks ($t=-2.37, p=.019$).

Zautra, Smith, Affleck et al. (2001)	Study 1: females with arthritis (n=175); study 2: females with fibromyalgia (n=89)	self-report pain intensity on numerical rating scale (0-6)	PANAS; measure taken from arthritis group weekly (state) and also averaged across weeks (trait); fibromyalgia participants reported daily (state) and averaged across days (trait)	Hierarchical linear regressions revealed weekly negative affect (NA) was lower when average weekly positive affect (PA) was high overall ($t=-4.67, p<.001$) and during high pain weeks ($t=-3.17, p<.01$). In Study 2, similar findings were found in fibromyalgia patients showing daily PA predicted lower daily NA when pain was high ($t=-3.01, p<.01$).
Zautra, Johnson & Davis (2005)	124 females with fibromyalgia (n=86) and/or osteoarthritis (n=38)	Self-reported weekly OA or fibromyalgia pain intensity level (scale 1-100)	Weekly mood assessments with the PANAS-X ⁴ (state); average of scores across 10-12 weeks (trait/stable)	A significant interaction between higher weekly PA and reduced pain predicted lower weekly NA ($t=-3.25, p=.001, r^2=.01$). Inversely, lower weekly PA significantly predicted higher weekly NA ($t=-6.75, p<.001, r^2=.03$) and subsequent increase in pain in following weeks ($t=5.04, p<.001, r^2=.24$). Greater average positive affect reduced rises in negative affect when pain was high ($t=-3.83, p<.001, r^2=.11$), and those with greater average positive affect were less likely to have pain overall ($t=-2.90, p=.005, r^2=.04$).

¹Positive and Negative Affect Schedule (Watson, Clark & Tellegen, 1988)

² Daily Mood Scale (Diener & Emmons, 1984)

³ Visual Analogue Scale (VAS)

⁴ Positive and Negative Affect Schedule – X (Watson & Clark, 1994)

⁵ Profile of Mood States-Bipolar (Lorr & McNair, 1988)

⁶ Western Ontario MacMaster Universities Arthritis Index (McConnell, Kolopack, & Davis, 2001)

⁷ Quantitative Sensory Tests (suprathreshold thermal phasic pain and temporal summation of mechanical phasic pain)

⁸ Ego-Resiliency Scale (Block & Kremen, 1996)

Table 2. Self-report studies exploring self-compassion (SC) ¹, positive emotion/affect (PA) and relevant correlates.

Citation	Participants	Relevant Measures	Relevant Significant Findings
Krieger, Hermann, Zimmerman & Grosse Holtforth (2015)	101 non-clinical participants (21 male, 80 female)	PA/NA (using 10 mood adjectives, rated 1-5)	Multilevel regression analyses indicated significant associations between SC and PA ($B=0.274$, $p<.01$) and SC and NA ($B= -.343$, $p<.001$)
Neff, Kirkpatrick, & Rude (2007)	177 undergraduate students (57 men; 120 women)	PA ² ; happiness ³ ; optimism ⁴ ; personal initiative ⁵ ; curiosity and exploration ⁶	Significant positive correlations between SC and happiness ($r=.57$), optimism ($r=.62$), PA ($r=.34$), personal initiative ($r=.45$) curiosity and exploration ($r=.28$) (all $p<.05$).
Neff & Vonk (2009)	165 undergraduate students (56 men, 109 women)	PA ² ; happiness ³ ; optimism ⁴	SC significantly positive correlated with PA ($r=.22$, $p<.05$), happiness ($r=.29$, $p<.001$) and optimism ($r=.33$, $p<.001$)
Phillips & Ferguson (2013)	185 adults aged 65 and older (79 men, 105 women, 1 unspecified)	PA ²	Significant positive correlation between SC and PA ($r=.26$, $p<.01$)

Sirois, Kitner, & Kirch (2015)	15 independent samples (N=3,252)	PA/NA ²	<p>Significant correlations between SC and PA across all samples ($r=.32-.60$, $ps<.01$) except one ($r=.16$, $p>.05$).</p> <p>Small but significant effect size (mean $r = .25$; $p < .001$) of self-compassion on health behaviors was found. Multiple mediator analyses indicated small but significant indirect effects (IEs) of self-compassion on health behaviors through positive and negative affect. Separate meta-analyses IEs were significant for positive (mean $IE = .08$; $p < .001$) and negative affect (mean $IE = .06$; $p < .001$), and combined IEs (mean $IE = .15$; $p < .0001$).</p>
Wei, Liao, Ku & Shaffer (2011)	College students (n=195; 55% women) and community adults (n= 136; 43% female)	PA ²	Significant positive correlations found between SC and PA in the undergraduate sample ($r=.30$, $p<.01$) and community adults ($r=.43$, $p<.01$)

¹ Self-Compassion Scale (Neff, 2003b)

² Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegan, 1988)

³ Subjective Happiness Scale (SHS; Lyubomirsky & Lepper, 1999)

⁴ Life-Orientation Test-Revised (LOT-R; Scheier, Carver, & Bridges, 1994)

⁵ Personal Growth Initiative Scale (PGIS; Robitschek, 1998)

⁶ Curiosity and Exploration Inventory (CEI; Kashdan, Rose, & Fincham, 2004)

Table 3. Summary of relevant studies exploring self-compassion in samples with chronic pain.

Citation	Sample	Pain Type	Outcome/Other Measures	SC Interventions/ Measures	Relevant Study Findings
Carson et al. (2005)	n = 43 (LKM, n=18; control, n=25) ; mean ages 26-80; 61% female	Chronic low back pain	Pain intensity ³ ; usual and worst pain ⁴ ; trait and state anger ⁵ ; daily anger and tension (subjective 0-100, twice daily); psychological distress ⁶	LKM (8-week/1.5 hours per week) ¹	Within-group pre-post changes in LKM group, with significant reductions in pain intensity, ($F(1, 17) = 5.67, p = .03$), usual pain $F(1, 17) = 5.04, p = .04$ and psychological distress, $F(1, 17) = 6.17, p = .02$). Changes were still significant at 6 month follow up. Treatment effects on daily variables were also significant, with sig. improvements in daily Anger ($b = -.214, t = -2.98, p < .01$) and tension ($b = -.388, t = -3.62, p < .01$). Pre to post practice effects were significant, where greater daily LKM practice led to significant reductions in pain the same day ($b = -.154, t = -3.35, p < .01$) and anger the next day ($b = -.151, t = -1.68, p = .09$).

Costa & Pinto-Gouveia (2011)	n = 103; mean age = 60.81 (males); 59.53 (females); 78% female	Rheumatoid arthritis (n=40) and unspecified chronic pain (n=63)	Pain acceptance ⁷ ; psychopathology ⁸	SCS ²	Low acceptance group reported significantly lower SC across the three negative domains compared to high acceptance group (self-judgment - $F(92,90) = 12.915$; $p \leq 0.001$; isolation - $F(92,90) = 11.237$; $p \leq 0.001$; overidentification - $F(91,89) = 12.003$; $p \leq 0.001$). The low acceptance group showed low scores across the positive domains of SC than the high acceptance group (kindness - $F(91,89) = 7.087$; $p \leq 0.001$; common humanity - $F(91,89) = 11.441$; $p \leq 0.001$; mindfulness - $F(92,90) = 7.062$; $p \leq 0.001$).
Costa & Pinto-Gouveia (2013)	n = 103; mean age = 60.81 (males); 59.53 (females); 78% female	Rheumatoid arthritis (n=40) and unspecified chronic pain (n=63)	Psychopathology ⁸	SCS ²	SC was significantly correlated with depression ($r = -.609$; $p \leq .001$), anxiety ($r = -.373$; $p \leq .001$) and stress ($r = -.588$; $p \leq .001$).
Tonelli & Wachholtz (2014)	n = 27; ages 26-71; 68% female	Migraine pain (episodic and chronic)	Migraine-related pain and emotional tension ⁹	LKM ¹ (20-min)	Significant decline from pre- to post-treatment in both reported pain ($t(26) = 5.23$; $p < .001$) and emotional tension ($t(26) = 5.47$; $p < .001$) scores.
Vowles, Witkiewitz, Sowden & Ashworth (2014)	n=117; mean age = 45.5 years;	Heterogeneous chronic pain	Pain acceptance ⁷	SCS ² ; ACT ¹⁰	Multiple mediator analyses showed pain acceptance and SC were strongest overall mediators, with SC being a unique and significant mediator of change in psychological disability ($B=.85$, $B= -.02$, indirect effects(IE) = $-.01$); depression ($B=.86$, $B = -.01$, $IE= -.01$); pain-

71.8%
female

related anxiety ($B=.88$, $B= -.1.21$, $IE = -1.07$); number of medical visits ($B=.85$, $B= 3.61$, $IE =3.05$), number of prescribed analgesics ($B=.95$, $B = -1.76$, $IE = -1.68$) and the only significant mediator of change in non-physical disabilities ($B=.85$, $B= -.005$, $IE = -.004$) (all $p<.01$).

¹ Loving-Kindness Meditation (Salzberg, 1995)

² Self-Compassion Scale (Neff, 2003b)

³ McGill Pain Questionnaire (MPQ; Melzack, 1975)

⁴ Brief Pain Inventory (BPI; Cleeland, 1989)

⁵ State-Trait Anger Expression Inventory-II (STAX-II; Spielberger, 1999)

⁶ Brief Symptom Inventory (BSI; Derogatis & Melisaratos, 1983)

⁷ Chronic Pain Acceptance Questionnaire (CPAQ; McCracken, Vowles, & Eccleston, 2004)

⁸ Depression, Anxiety and Stress Scale (DASS; Lovibond & Lovibond, 1995)

⁹ 11-item Numeric Rating Scale (NRS-11; Krebs, Carey & Weinberger, 2007) – adapted for use to assess pain and emotional tension

¹⁰ Acceptance and Commitment Therapy (ACT; Hayes, Strosahl, & Wilson, 1999)

Table 4. Studies examining the role of self-compassion (SC) and positive emotion/affect (PA) in chronic pain.

Citation	Sample characteristics	Pain Type	Measures/Interventions	Relevant Study Findings
Wren et al. (2012)	n = 88; obese patients; average age = 53.93; 71.6% female	Chronic musculoskeletal leg, neck or back pain	PA/NA ¹ ; SC ² ; pain intensity and unpleasantness ³ , catastrophizing ⁴ , disability ⁵	Significant correlation between SC and PA ($r=0.31, p<0.01$) and NA ($r=-0.52, p<0.01$). Hierarchical linear regression indicated that SC was a significant, independent predictor of PA ($\beta=0.29, t=2.53, p<0.05$) and NA ($\beta=0.48, t=4.81, p<0.001$).
Davis & Zautra (2013)*	n=79 (n=39 to tx condition; n=40 control); mean age =46.14; 98% female	Fibromyalgia pain	PA/NA ¹ ; MSER ⁶ (online intervention)	The MSER condition showed marginally significant increases in positive affect ($t=1.81, p<.07$). Change in negative affect was similar across groups.
Kranz, Bollinger & Nilges (2010)*	n=150; mean age = 49; 62.7% female	Heterogeneous chronic pain	PA/NA ¹ ; pain intensity; chronic pain acceptance ⁷ (pain willingness (PW)/activity engagement (AE)) ⁷	Correlation was $r=.27, p<.01$ between pain willingness and PA, and $r=.51, p<.01$ between AE and PA; multiple regression analyses indicated AE ($Beta = .43, SD = .07, p < .001$) but not PW ($Beta = .02, SD = .08$) fully mediated changes in positive affect ($R^2 = .26, p < .001$).
Payne, Murphy & Beacham (2015)*	n=300; mean age =44.73; 83.3% female	Heterogeneous chronic pain	PA/NA ¹ ; Pain disability ⁵	The low-low acceptance group had the least positive affect (Mean = 20.28) while the high-high group showed the most positive affect (Mean = 32.03). The med-med group revealed had moderate positive affect (Mean = 26.85).

Significant but inverse effects were found for negative affect.

* Studies that examine correlates of self-compassion in relation to positive emotion in chronic pain, but not SC specifically.

¹ Positive and Negative Affect Schedule (Watson, Clark & Tellegen, 1988)

² Self-Compassion Scale (Neff, 2003b)

³ Visual Analogue Scale (VAS; 0-100)

⁴ Coping Strategies Questionnaire – catastrophizing subscale (Jensen et al., 2003)

⁵ Pain Disability Index (PDI; Pollard, 1984)

⁶ Mindful Socioemotional Regulation (MER; Davis & Zautra, 2013)

⁷ Chronic Pain Acceptance Questionnaire (CPAQ; McCracken, Vowles, & Eccleston, 2004)

Table 5. Sociodemographic Characteristics of the Sample* (n=84).

Demographic	Frequency	Percentage
Gender		
Male	31	36.9%
Female	53	63.1%
Ethnicity		
Caucasian	53	63.1%
African American	29	34.5%
Hispanic	1	1.2%
Biracial	1	1.2%
Marital Status		
Never Married	20	23.8%
Currently Married	36	42.9%
Separated	1	1.2%
Divorced	21	25%
Widowed	4	4.8%
Other	2	2.4%
Living Situation		
Lives alone	21	25%
Lives with spouse/partner	28	33.3%
Lives with spouse/partner and children	15	17.9%
Lives with children/no partner	9	10.7%
Lives with roommate	8	9.5%

Table 5 (continued). Sociodemographic Characteristics of the Sample* (n=84).

Lives with parents	2	2.4%
Other	1	1.2%
Education Status		
12 th grade or less	18	21.4%
High school graduate (includes G.E.D)	19	22.6%
Some college/A.A degree/tech school training	31	36.9%
College graduate (B.A./B.S.)	9	10.7%
Graduate school degree (Masters or Doctorate – e.g. M.A., M.S., Ph.D., MD)	7	8.3%
Employment Status		
Working full-time	21	25%
Working part-time	5	6%
Not working/not looking for work	2	2.4%
Unemployed and looking for work	1	1.2%
Seeking disability	11	13.1%
Disabled or retired	41	48.8%
Currently in school	1	1.2%
Working full-time/in school	1	1.2%
Seeking disability/in school	1	1.2%
Combined Annual Income		
<\$5,000	14	16.7%
\$5,000 - \$19,999	25	29.8%

Table 5 (continued). Sociodemographic Characteristics of the Sample* (n=84).

\$20,000 - \$49,999	20	23.8%
\$50,000 - \$99,999	13	15.5%
\$100,000 - \$149,999	5	6.0%
>\$150,000	7	8.3%

Table 6. Sample Sociodemographic Characteristics Compared to U.S. Census Bureau Statistics from 2016 by County, State and Country.

Demographic	Study Sample (n=84)	Jefferson County	Kentucky	U.S.
<i>Gender</i>				
Male	36.9%	48.3%	49.3%	49.2%
Female	63.1%	51.7%	50.7%	50.8%
<i>Ethnicity</i>				
Caucasian	63.1%	72.7%	88.0%	76.9%
African American	34.5%	21.8%	8.3%	13.3%
Hispanic	1.2%	5.1%	3.5%	17.8%
Biracial	1.2%	2.3%	1.9%	2.6%
<i>Education Status</i>				
High school graduate (includes G.E.D)	78.6%	89.3%	84.6%	87%
<i>Combined Annual Income</i>	46.4% <\$20,000	50% <\$50,999	50% <\$44,811	50% <\$55,322

Table 7. Pain Characteristics of the Sample (n=84).

Pain Statistics	<i>M</i>	<i>SD</i>
<i>Pain Intensity (0-10 per the Numerical Rating Scale)</i>		
Current pain	5.44	2.45
Average pain over past week	5.25	1.91
Highest pain in last week	7.73	1.95
Lowest pain in last week	3.67	2.08
Pain Duration (in years)	9.09	6.64
<i>Primary Pain Location</i>	Frequency	Percentage
Lower back	58	69%
Lower extremities	11	13.1%
Neck	5	6%
Upper back/shoulders	4	4.8%
Upper extremities	4	4.8%
Head (headaches, migraines)	1	1.2%
Face (eyes, ears, nose, jaw, teeth)	1	1.2%
Number of locations		
One area	9	10.7%
Two areas	33	39.3%
Three or more areas	42	50%
<i>Pain-related Diagnoses</i>	Frequency	Percentage
Bulging/herniated disc	54	64.3%
Degenerative disc disease	53	63.1%

Fibromyalgia	13	15.5%
Chronic migraine	5	6%
Arthritis (e.g. osteoarthritis, rheumatoid)	5	6%
Spinal stenosis	4	4.8%
Sciatica	3	3.6%
Bursitis (e.g. shoulder, hip)	3	3.6%
Failed back surgery syndrome (FBSS)	2	2.4%
Complex regional pain syndrome (CPRS)	2	2.4%
Other	7	8.3%
<i>Treatments Tried</i>	Frequency	Percentage
Prescription medications (e.g. narcotics, muscle relaxers)	77	91.7%
OTC medication	68	81%
Physical therapy	63	75%
Anesthetic injection	62	73.8%
Massage	31	36.9%
Chiropractic	23	27.4%
Surgery	20	23.8%
Counseling/therapy	17	20.2%
Acupuncture	8	9.5%
Implantable device	7	8.3%
Other	9	10.7%
<i>Reported Successful Treatments</i>		
Prescription medications	58	69%

Anesthetic injection	47	56%
Physical therapy	16	19%
Surgery	12	14.3%
Chiropractic	12	14.3%
OTC medication	10	11.9%
Massage	10	11.9%
Implantable device	4	4.8%
Counseling/therapy	1	1.2%
Acupuncture	1	1.2%
Other	7	8.3%
<i>Appointment Type</i>		
Initial Visit	13	14.9%
Procedure Visit	11	12.6%
Follow-up Visit	62	71.3%

Table 8. Psychological Characteristics of the Sample (n=84).

Psychological Characteristics	Frequency	Percentage
<i>Before Pain</i>		
Sleep difficulties	42	50%
Depression	31	36.9%
Anxiety	26	31%
Panic attacks	17	20.2%
Other psychological difficulties	6	7.1%
No psychological difficulties	31	63.1%
<i>After Pain</i>		
Sleep difficulties	68	81%
Depression	55	65.5%
Anxiety	42	50%
Panic attacks	20	23.8%
Other psychological difficulties	4	4.8%
No psychological difficulties	8	9.5%
Current Psychiatric Diagnoses		
Yes	26	31%
No	58	69%

Table 9. Study Variable Characteristics of the Sample (n=84).

Study Measure	Possible Score Range	Mean	SD
Positive and Negative Affect Schedule (PANAS) - Positive subscale	1-5	2.74	.96
Positive and Negative Affect Schedule (PANAS) - Negative subscale	1-5	2.13	.89
Modified Differential Emotions Scale (mDES) - Positive subscale	0-4	2.20	.93
Modified Differential Emotions Scale (mDES) - Negative subscale	0-4	1.26	.93
Self-Compassion Scale (SCS)	1-5	3.30	.64
Self-kindness subscale	1-5	2.87	.94
Self-judgment subscale	1-5	2.50	.96
Common humanity subscale	1-5	2.91	.89
Isolation subscale	1-5	2.38	1.08
Mindfulness subscale	1-5	3.20	.86
Over-identification subscale	1-5	2.31	.99
Chronic Pain Acceptance Questionnaire (CPAQ)	0-120	59.07	19.01
Pain willingness subscale	0-54	23.42	9.52
Activity engagement subscale	0-66	35.65	12.39
Mindful Attention Awareness Scale (MAAS)	1-6	4.27	.73
Pain Disability Index (PDI)	0-100	38.83	16.84
Medical Outcomes Study – Short Form (MOS SF-12)			
Mental Component Summary (MCS)	0-100	43.81	11.32
Physical Component Summary (PCS)	0-100	30.30	9.56

Table 10. Pearson bivariate correlations between positive and negative affect, average pain severity, pain disability and mental and physical health QoL.

Measure	1.	2.	3.	4.	5.	6.	7.	8.
1. Positive affect (PANAS)	—							
2. Negative affect (PANAS)	-.223*	—						
3. Positive affect (mDES)	.692*	-.355*	—					
4. Negative affect (mDES)	-.227*	.860**	-.346**	—				
5. Average pain severity (NRS)	-.365**	.308**	-.317**	.322**	—			
6. Pain disability (PDI)	-.311**	.435**	-.391**	.476**	.579**	—		
7. QoL – Physical component (MOS SF-12)	.216*	-.098	.179	-.135	-.359**	-.669**	—	
8. QoL – Mental component (MOS SF-12)	.540**	-.598**	.594**	-.598**	-.484**	-.614**	.207	—

$p < .05^*$, $p < .01^{**}$

Table 11. Pearson bivariate correlations between self-compassion (SCS) overall score and its subscales, pain acceptance (CPAQ), and mindfulness (MAAS).

	SCS Overall Mean	Self- Kindness	Self- Judgment	Common Humanity	Isolation	Mindfulness	Overidentification
MAAS	.315**	-.081	-.356**	-.002	-.447**	.052	-.426**
CPAQ – Total	.530**	.308**	-.325**	.213	-.502**	.346**	-.415**
CPAQ – Pain Willingness	.364**	.065	-.300**	.048	-.460**	.150	-.387**
CPAQ – Activity Engagement	.538**	.424**	-.270**	.291**	-.421**	.418**	-.343**

$p < .05^*$, $p < .01^{**}$

Table 12. Pearson bivariate correlations between self-compassion (SCS), subscales and dependent variables.

SCS Subscales	SCS Overall Mean	Self- Kindness	Self- Judgment	Common Humanity	Isolation	Mindfulness	Overidentification
Positive affect (PANAS)	.464**	.370**	-.244*	.290**	-.276*	.458**	-.256*
Negative affect (PANAS)	-.589**	-.103	.634**	-.018	.655**	-.156	.708**
Positive affect (mDES)	.538**	.417**	-.278*	.243*	-.391**	.540**	-.312**
Negative affect (mDES)	-.580**	-.116	.636**	.040	.686**	-.148	.689**
Average pain severity (NRS)	-.286**	-.267*	.172	-.073	.223*	-.175	.231*
Pain disability (PDI)	-.499**	-.256*	.438**	-.046	.467**	-.282**	.477**
QoL – Physical Component (MOS SF-12)	.239*	.223*	-.101	.192	-.100	.243*	-.126
QoL – Mental Component (MOS SF-12)	.578**	.259*	-.464**	.124	-.545**	.367**	-.526**

$p < .05^*$, $p < .01^{**}$

Table 13. Pearson bivariate correlations between self-compassion (SCS), mindfulness (MAAS), pain acceptance (CPAQ) and subscales, and dependent variables.

	Self-compassion (SCS)	Mindfulness (MAAS)	Pain Acceptance (CPAQ –Total)	Pain Willingness (CPAQ-PW)	Activity Engagement (CPAQ-AE)
Positive affect (PANAS)	.464 [*]	.245 [*]	.586 ^{**}	.435 ^{**}	.570 ^{**}
Negative affect (PANAS)	-.589 ^{**}	-.351 ^{**}	-.411 ^{**}	-.323 ^{**}	-.386 ^{**}
Positive affect (mDES)	.538 [*]	.141	.590 ^{**}	.328 ^{**}	.657 ^{**}
Negative affect (mDES)	-.580 ^{**}	-.340 ^{**}	-.440 ^{**}	-.361 ^{**}	-.402 ^{**}
Pain severity (NRS)	-.286 ^{**}	-.078	-.459 ^{**}	-.318 ^{**}	-.463 ^{**}
Pain disability (PDI)	-.499 ^{**}	-.203	-.699 ^{**}	-.567 ^{**}	-.642 ^{**}
QOL - PCS (MOS SF-12)	.239 [*]	.041	.602 ^{**}	.533 ^{**}	.519 ^{**}
QOL – MCS (MOS SF-12)	.578 ^{**}	.340 ^{**}	.582 ^{**}	.458 ^{**}	.547 ^{**}

$p < .05^*$, $p < .01^{**}$

Table 14. Hierarchical Multiple Regression: Self-compassion (SCS), Mindfulness (MAAS), Pain Acceptance (CPAQ) and covariates (gender, annual combined household income) predicting Positive Affect (mDES).

Variable	Model 1				Model 2				Model 3			
	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>
Gender	-.282	.208	-.147	-1.356	-.337	.167	-.176	-2.018*	-.287	.160	-.150	-1.795
Income	.112	.069	.176	1.616	-.114	.065	-.178	-1.739	-.104	.062	-.164	-1.672
Mindfulness					-.046	.117	-.036	-.393	-.118	.114	-.092	-1.032
Pain Acceptance					.034	.005	.704	6.620**	.027	.006	.548	4.822**
Self-Compassion									.440	.145	.305	3.030**
R ²			.049				.404				.467	
Adj. R ²			.025				.374				.433	
ΔR^2			.049				.355				.063	
ΔF			2.074				25.569**				9.184**	

* $p < .05$; ** $p < .01$

Outcome Variable: Positive Affect

Table 15a. Hierarchical Multiple Regression: Self-compassion (SCS), Mindfulness (MAAS), Pain Acceptance (CPAQ) and covariates (gender, annual combined household income) predicting Negative Affect (mDES).

Variable	Model 1				Model 2				Model 3			
	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>
Gender	-.201	.209	-.105	-.958	-.127	.188	-.067	-.679	-.203	.171	-.106	-1.188
Income	-.098	.070	-.153	-1.400	.023	.073	.036	.315	.009	.067	.014	.132
Mindfulness					-.292	.131	-.229	-2.223	-.184	.122	-.145	-1.515
Pain Acceptance					-.019	.006	-.392	-3.290**	-.008	.006	-.157	-1.298
Self-Compassion									-.662	.155	-.458	-4.271**
R ²		.037				.252				.394		
Adj. R ²		.013				.215				.355		
ΔR^2		.037				.216				.142		
ΔF		1.546				11.390**				18.241**		

* $p < .05$; ** $p < .01$

Outcome Variable: Negative Affect

Table 15b. Hierarchical Multiple Regression: Self-compassion (SCS), Mindfulness (MAAS), Pain Acceptance (CPAQ) and covariates (gender, annual combined household income, and age) predicting Negative Affect (mDES).

Variable	Model 1				Model 2				Model 3			
	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>
Age	-.019	.009	-.237	-2.20*	-.020	.008	-.245	-2.560*	-.015	.007	-.185	-2.080*
Gender	-.139	.206	-.073	-.675	-.066	.183	-.034	-.360	-.150	.169	-.078	-.887
Income	-.108	.068	-.169	-1.577	.022	.071	.034	.304	.009	.065	.014	.135
Mindfulness					-.261	.127	-.205	-2.050	-.170	.119	-.133	-1.425
Pain Acceptance					-.020	.006	-.418	-3.616**	-.010	.006	-.196	-1.634
Self- Compassion									-.608	.154	-.420	-3.945**
R ²			.092				.310				.426	
Adj. R ²			.058				.266				.382	
ΔR^2			.092				.219				.116	
ΔF			2.693				12.361**				15.564**	

* $p < .05$; ** $p < .01$

Outcome Variable: Negative Affect

Table 16. Hierarchical Multiple Regression: Self-compassion (SCS), Mindfulness (MAAS), Pain Acceptance (CPAQ) and covariates (gender and annual combined household income) predicting Pain Severity (NRS).

Variable	Model 1				Model 2				Model 3			
	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>
Gender	-.353	.376	-.089	-.938	-.302	.368	-.077	-.819	-.338	.370	-.086	-.912
Income	-.660	.125	-.503	-5.270**	-.488	.144	-.372	-3.389**	-.495	.144	-.377	-3.430**
Mindfulness					-.027	.258	-.010	-.105	.025	.264	.009	.093
Pain Acceptance					-.026	.011	-.262	-2.307	-.021	.013	-.207	-1.625
Self-Compassion									-.318	.336	-.107	-.946
R ²			.267				.320				.328	
Adj. R ²			.249				.285				.285	
ΔR^2			.267				.053				.008	
ΔF			14.772**				3.058				.895	

* $p < .05$; ** $p < .01$

Outcome Variable: Pain Severity

Table 17. Hierarchical Multiple Regression: Self-compassion (SCS), Mindfulness (MAAS), Pain Acceptance (CPAQ) and covariates (gender and annual combined household income) predicting Pain Disability (PDI).

	Model 1				Model 2				Model 3			
Variable	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>
Gender	-2.333	3.445	-.067	-.677	-1.231	2.770	-.035	-.444	-1.824	2.727	-.053	-.669
Income	-5.138	1.148	-.444	-4.475**	-1.574	1.084	-.136	-1.452	-1.686	1.062	-.146	-1.587
Mindfulness					-.893	1.939	-.039	-.460	-.047	1.941	-.002	-.024
Pain Acceptance					-.544	.086	-.617	-6.356**	-.454	.094	-.515	-4.832**
Self-Compassion									-5.200	2.475	-.198	-2.101*
R ²		.206				.504				.530		
Adj. R ²		.187				.478				.500		
ΔR^2		.206				.297				.027		
ΔF		10.520**				23.663**				4.415*		

* $p < .05$; ** $p < .01$

Outcome variable: Pain Disability

Table 18a. Hierarchical Multiple Regression: Self-compassion (SCS), Mindfulness (MAAS), Pain Acceptance (CPAQ) and covariates (gender and annual combined household income) predicting the Mental Components of Quality of Life (MOS SF-12 MCS).

Variable	Model 1				Model 2				Model 3			
	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>
Gender	1.721	2.505	.074	.687	.749	2.085	.032	.359	1.452	1.965	.062	.739
Income	1.934	.835	.249	2.316*	-.102	.816	-.013	-.125	.031	.765	.004	.041
Mindfulness					3.012	1.460	.194	2.063	2.009	1.399	.130	1.437
Pain Acceptance					.317	.064	.535	4.915**	.210	.068	.355	3.105**
Self-Compassion									6.170	1.783	.350	3.460**
R ²			.070				.377				.460	
Adj. R ²			.047				.345				.425	
ΔR^2			.070				.307				.083	
ΔF			3.051				19.446**				11.970**	

* $p < .05$; ** $p < .01$

Outcome variable: Mental Component of QoL

Table 18b. Hierarchical Multiple Regression: Self-compassion (SCS), Mindfulness (MAAS), Pain Acceptance (CPAQ) and covariates (gender and annual combined household income) predicting the Physical components of Quality of Life (MOS SF-12 PCS).

Variable	Model 1				Model 2				Model 3			
	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>
Gender	2.010	1.895	.102	1.061	1.719	1.692	.087	1.016	1.615	1.708	.082	.946
Income	3.194	.632	.486	5.055**	1.516	.662	.231	2.291*	1.496	.665	.228	2.249*
Mindfulness					-1.245	1.184	-.095	-1.051	-1.096	1.216	-.084	-.902
Pain Acceptance					.252	.052	.504	4.822**	.268	.059	.535	4.548**
Self-Compassion									-.915	1.550	-.061	-.590
R ²			.254				.425				.428	
Adj. R ²			.236				.396				.391	
ΔR^2			.254				.171				.003	
ΔF			13.810**				11.763**				.349	

* $p < .05$; ** $p < .01$

Outcome variable: Physical Component of QoL

Table 19. Moderation analyses: average pain severity over the last week and positive affect as moderated by self-compassion, controlling for effects of annual household income (Model 3).

Variable	Model 1				Model 2				Model 3			
	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>
Income	.003	.078	.004	.035	-.020	.068	-.031	-.288	-.018	.069	-.029	-.264
Pain Severity	-.153	.059	-.315	-2.573*	-.094	.053	-.193	-1.758	-.093	.054	-.191	-1.727
Self-Compassion					.707	.139	.489	5.067**	.709	.141	.491	5.039**
Self-Compassion*Pain Severity									.016	.074	.020	.219
R ²		.101				.319				.320		
Adj. R ²		.078				.294				.285		
ΔR^2		.101				.219				.0004		
ΔF		4.532*				25.677**				.048		

* $p < .05$; ** $p < .01$

Table 20a. Moderation analyses: average pain severity over the last week and negative affect as moderated by self-compassion, controlling for effects of annual household income and age (Model 2).

Variable	Model 1				Model 2			
	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>
Income	-.023	.057	-.038	-.396	-.036	.056	-.060	-.642
Age	-.014	.006	-.187	-2.279*	-.012	.006	-.162	-2.027*
Self-compassion	-.722	.114	-.543	-6.341**	-.746	.111	-.561	-6.734**
Pain severity	.104	.044	.231	2.359*	.097	.043	.215	2.252*
Self-compassion*Pain severity					-.141	.058	-.195	-2.444*
R ²		.494				.531		
Adj. R ²		.468				.500		
ΔR^2		.494				.037		
ΔF		18.782**				5.971*		

* $p < .05$; ** $p < .01$

Table 20b. Conditional effects of average pain severity on negative affect at low, average and high values self-compassion.

Self-Compassion*	effect	<i>se</i>	<i>t</i>	<i>p</i>	LLCI	ULCI
-.647	.188	.058	3.43	.001	.079	.297
.000	.096	.043	2.26	.027	.011	.181
.647	.005	.059	.083	.934	-.112	.122

*Values for self-compassion are the mean and plus/minus one SD from mean.

Table 21. Moderation analyses: average pain severity over the last week and pain disability as moderated by self-compassion, controlling for effects of annual household income (Model 2).

Variable	Model 1				Model 2			
	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>
Income	-2.119	1.085	-.183	-1.953	-2.108	1.097	-.182	-1.922
Self-compassion	-9.262	2.210	-.353	-4.191**	-9.243	2.231	-.352	-4.144**
Pain severity	3.384	.845	.384	4.006**	3.391	.852	.385	3.979**
Self-compassion*Pain severity					.124	1.166	.009	.107
R ²		.481				.481		
Adj. R ²		.461				.455		
ΔR^2		.481				.000		
ΔF		24.705**				.011		

* $p < .05$; ** $p < .01$

Table 22. Moderation analyses: average pain severity over the last week and mental component of quality of life as moderated by self-compassion, controlling for effects of annual household income (Model 2).

Variable	Model 1				Model 2			
	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>
Income	-.118	.754	-.024	-.250	-.096	.754	-.012	-.128
Self-compassion	8.460	1.535	.480	5.511**	8.617	1.533	.489	5.620**
Pain severity	-2.126	.587	-.359	-3.624**	-2.070	.586	-.350	-3.534**
Self-compassion*Pain severity					1.043	.802	.109	1.301
R ²		.445				.457		
Adj. R ²		.424				.429		
ΔR^2		.445				.012		
ΔF		21.402**				1.692		

* $p < .05$; ** $p < .01$

Table 23a. Moderation analyses: average pain severity over the last week and physical component of quality of life as moderated by self-compassion, controlling for effects of annual household income (Model 2).

Variable	Model 1				Model 2			
	<i>B</i>	<i>SE B</i>	β	<i>t</i>	<i>B</i>	<i>SE B</i>	β	<i>t</i>
Income	2.795	.715	.421	3.911**	2.661	.691	.401	3.851**
Self-compassion	2.577	1.493	.167	1.725	2.696	1.440	.175	1.872
Pain severity	-.655	.557	-.129	-1.176	-.827	.541	-.163	-1.529
Self-compassion*Pain severity					-2.183	.824	-.241	-2.648**
R ²		.309				.366		
Adj. R ²		.283				.334		
ΔR^2		.309				.057		
ΔF		11.786**				7.013**		

* $p < .05$; ** $p < .01$

Table 23b. Conditional effects of average pain severity on the physical component of QoL at low, average and high values self-compassion.

Self-Compassion*	effect	<i>se</i>	<i>t</i>	<i>p</i>	LLCI	ULCI
-.621	.571	.709	.806	.423	-.840	1.98
.000	-.785	.539	-1.46	.149	-1.86	.288
.621	-2.14	.777	-2.76	.007	-3.69	-.596

*Values for self-compassion are the mean and plus/minus one SD from mean.

CURRICULUM VITAE

Melissa E. Ellsworth

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EDUCATION

- 07/2013 – Present **Doctor of Philosophy, Clinical Psychology** (*APA-Accredited*)
University of Louisville, Louisville, KY
Dissertation: *Fostering Positive Emotion through Self-Compassion in Individuals with Chronic Pain*
Anticipated Graduation: August 2018
Honors and Awards:
University Fellowship (July 2013-July 2015)
Cumulative GPA: 3.96
- 08/2017 – Present **Pre-doctoral Internship** (*APA-Accredited*)
VA Salt Lake City Health Care System, Salt Lake City, UT
Anticipated Date of Completion: August 3, 2018
- 07/2013 – 05/2016 **Master of Arts in Clinical Psychology**
University of Louisville, Louisville, KY
- 08/2004 – 05/2008 **Bachelor of Arts in Psychology, Magna Cum Laude**
University of Maryland, College Park, MD

PROFESSIONAL MEMBERSHIPS

- 11/2016 – Present APA Division 35 – Society for the Psychology of Women
- 11/2015 – Present Association for Behavioral and Cognitive Therapies (ABCT)
- Member of Special Interest Group in LGBT Issues

CERTIFICATIONS

- 08/2015 – Present Functional Analytic Psychotherapy (FAP) – Level 1

SUPERVISED CLINICAL EXPERIENCE

- 08/2017 – Present **VA Salt Lake City Health Care System**
Salt Lake City, UT
Training Director: Leland “Ben” Swanson, Ph.D.
This is a full-time, 12-month, APA-accredited, generalist program based on the scientist-practitioner model. Rotations include two 6-month major rotations: 1) neuropsychological

assessment and 2) assessment and interventions for military sexual trauma (MST). There are also three, four-month minor rotations in areas of assessment and intervention for a range of co-occurring mental and physical health disorders including substance abuse, trauma, neurocognitive disorders and chronic pain. Training rotations are as follows:

Neuropsychology Assessment (08/2017 – 02/2018)

- Conducted neuropsychological testing batteries in an outpatient medical setting. Consults received from diverse areas including Neurology, Primary Care, Geriatric Clinics and Outpatient Mental Health.
- Common referral questions related to differential diagnosis of neurocognitive, mental and physical health disorders.
- Testing battery includes WAIS-IV, WMS-IV, Boston Naming Test, COWA, Trails A/B and RCFT.

Addictions and Behavioral Medicine (08/2017-11/2017)

- As a member of an interdisciplinary substance abuse treatment team, responded to medical inpatient consults for patients with co-occurring medical and substance use disorders, and provided diagnostic assessment and treatment planning/referrals.
- Provided group behavioral management classes for Veterans, covering topics related substance use disorders, including chronic pain management, insomnia, tobacco cessation and mindfulness.
- Participated in integrative team meetings, including client case presentation and assisting with treatment referrals.

Integrative Health and Holistic Medicine (11/2017 – 2/2018)

- Responsibilities involved delivery of empirically-supported, integrative treatment modalities for Veterans with co-occurring mental and physical health conditions in an outpatient setting.
- Co-facilitated CBT group for individuals with chronic pain.
- Provided individual therapeutic interventions include Acceptance and Commitment Therapy (ACT), Mindfulness-based Cognitive Therapy (MBCT) and biofeedback.
- Co-facilitated mindfulness meditation groups and MBCT groups for Veterans and currently still leading an introduction to mindfulness and compassion class.
- Responded to consults from healthcare providers for Veterans who may benefit from integrative health

services using clinical interview and psychoeducation about services.

Geriatric Primary Care Assessment Clinic (11/2017 – 01/2018)

- As part of an interdisciplinary team in a primary care setting, conducted clinical assessments, brief neuropsychological testing and collaborative intervention planning for geriatric patients presenting with co-morbid neurocognitive, psychological and medical conditions.

Outpatient Psychotherapy (Military Sexual Trauma Team) (02/2018 – 08/2018)

- Anticipated activities include conducting evaluations and treatment for Veterans with military sexual trauma (MST).
- Will be trained in Cognitive Processing Therapy (CPT) for addressing MST in individual psychotherapy.
- Will co-facilitate process and skills-based psychotherapy groups for Veterans with MST, including a Men's MST, Women's MST, and LGBT Individuals with MST group.

Polytrauma and Caregiver Clinic (02/2018 – 05/2018)

- As part of an interdisciplinary team in a rehabilitation setting, conduct assessments for patients presenting with polytraumatic symptoms including traumatic brain injury and PTSD.
- Provide collaborative intervention planning on an interdisciplinary team with physicians, occupational and physical therapists, and social workers.
- Assess patients' caregiver needs and determine appropriate interventions including individual psychotherapy and other caregiver support resources.

Physical Medicine and Rehabilitation (05/2018 – 08/2018)

- This rotation will take place off-site at the University of Utah Hospital Inpatient Medical Rehabilitation Unit. Anticipated activities include providing brief neuropsychological and neurocognitive assessment highlighting functional changes associated with various acute and chronic neurologic conditions including TBI, stroke and spinal cord injury.
- Will assess and treat the psychological aspects of adjustment to disability.
- Consultation as part of an interdisciplinary team with medicine, OT/PT, social work, nursing and psychiatry.

- Training opportunities also involve evaluation and treatment of co-occurring pain and substance use disorders in this population.
- Will also provide caregiver intervention and support

10/2014 – 06/2017 Pain Management Center, University of Louisville Hospital
Louisville, KY

Supervisor: Brian Monsma, Ph.D.

- Provided brief and long-term therapy for low-income patients experiencing difficulties with chronic pain management as well as co-morbid psychological and physical conditions.
- Provided psychoeducation in the biopsychosocial model of chronic pain management.
- Assisted with health behavior self-management including improving diet and exercise, sleep hygiene, smoking cessation, and substance use relapse prevention.
- Applied therapeutic techniques from evidence-based practices, including motivational interviewing, cognitive-behavioral therapy and acceptance and mindfulness-based therapies.
- Assessed patients' readiness and capacity for maintaining implanted spinal cord stimulator devices through multimodal assessment procedures, including semi-structured clinical interviews, Montreal Cognitive Assessment (MOCA), and self-report measures.
- Consulted with physicians and nurses in providing integrative and comprehensive patient care through psychoeducation and collaborative treatment planning.
- Provided didactic workshops for multidisciplinary health professionals in the field of chronic pain management and rehabilitation.

09/2015 – 09/2016 Kentucky Disability Assessment Services
Louisville, KY

Supervisor: David Winsch, Ph.D.

- Assessed children, adolescents and adults seeking disability services in Kentucky for a range of conditions, including behavioral difficulties, developmental and learning disabilities, psychiatric and medical conditions.
- Conducted diagnostic interviews, neuropsychological and psychodiagnostic assessments including the Beery-VMI, CAARS, GARS, MCMI-III, MMPI, Rey Memory Test, VABS-II, WAIS-IV, WISC-IV and WRAT.

07/2013 – 07/2017 Psychological Services Center (PSC), University of Louisville
Louisville, KY

Cognitive-Behavioral Therapy Team (08/2016 – 07/2017)

Supervisor: Janet Woodruff-Borden, Ph.D.

Integrated Interventions Team (08/2015 – 08/2016)

Supervisor: Richard Lewine, Ph.D.

Mindfulness Team (08/2013 – 08/2015)

Supervisor: Paul Salmon, Ph.D.

- Provided individual psychotherapy for clients with a range of complex, psychosocial difficulties using a variety of evidence-based treatments, including cognitive-behavioral therapy and acceptance and mindfulness-based therapies.
- Treated clients from the Cardinal Covenant program, a university scholarship program provided to students living below the poverty line.
- Conducted semi-structured clinical interviews for potential clients and wrote integrative reports.
- Administered neuropsychiatric and psychodiagnostic assessment batteries for clients including the ADIS-IV, CFI, MCMI-III, MMPI-II, WAIS-IV, WISC-IV and WJ-III.
- Wrote and presented case conceptualizations for active clients.
- Actively contribute to clinical team's client discussion in terms of evaluation of presenting issues, therapeutic goals and intervention planning.

CLINICAL VOLUNTEER EXPERIENCE

10/2013 – 07/2017 **Depression and Bipolar Support Alliance**

Louisville, KY

Served as a board member and group facilitator for this community-based mental health support group serving individuals primarily with Depressive and Bipolar I/II Disorders, as well as a number of other mental health issues.

RESEARCH EXPERIENCE

09/2017 – Present **Doctoral Dissertation**

University of Louisville, Louisville, KY

Dissertation Chairs: Richard Lewine, Ph.D.

Committee Members: Barbara Stetson, Ph.D.; Cara Cashion, Ph.D.; Brian Monsma, Ph.D., Sandra Sephton, Ph.D.

Title: *Fostering Positive Emotion through Self-Compassion in Individuals with Chronic Pain*

Defense Date: August 7, 2018

In a hospital-based sample of patients with chronic, non-malignant pain, this study examined whether self-compassion would predict unique variance in changes in positive emotion when compared with other important resilience factors,

acceptance and mindfulness, and determined whether self-compassion would predict unique variance in predicting reductions in pain severity, disability and quality of life.

07/2013 – 12/2015 Graduate Student

Mindfulness and Biobehavioral Research Lab

University of Louisville, Louisville, KY

Supervisors: Sandra Sephton, Ph.D.; Paul Salmon, Ph.D.

- Conduct independent and collaborative research protocols in the area of resilience factors as it applies to a variety of psychological and physical health difficulties, specifically focusing on mindfulness, acceptance, self-compassion and other positive psychology factors.
- Assisted with lab studies examining the role of mindfulness across a number of different clinical disorders, aiding in recruitment, data analysis, poster presentations and manuscript development, including study coordinator for two lab studies; recruitment efforts and administering study protocols; data analysis, including physiological data interpretation using BioInfiniti Physiological Suite and SPSS statistical software; developed abstracts/poster presentations using lab data; worked on manuscripts that examined novel hypotheses and findings from lab data analysis.

07/2014 – 11/2015 Graduate Student (Collaborator)

Center for Mental Health Disparities

University of Louisville, Louisville, KY

- Assist with lab study arm involving LGBTIQ research, including recruitment, data analysis, poster presentations and manuscript development.
- Assisted with manuscripts on mental health disparities in minority populations.

03/2011 – 03/2013 Research Analyst/Lab Manager

Psychiatric Neuroimaging Program

Vanderbilt Medical Center, Nashville, TN

Study Objectives: NIH-funded study examining differences in neurobiological and behavioral substrates of reward processing in adolescents with ADHD as risk factors for substance abuse later in life. Used fMRI brain imaging to examine activation of the ventral striatum and prefrontal cortex during monetary decision-making tasks, and assess differences in reward salience and immediate or delayed reward preferences. Responsibilities included:

- Recruiting and screening potential participants for participation eligibility in research study procedures, including children and parents from diverse backgrounds.

- Administering empirical clinical assessments with parents and children to assess for psychiatric disorders and intellectual functioning.
- Administering computer-based monetary tasks (using E-Prime) during fMRI to examine brain activation data during these tasks and assess patterns in regions of interest.
- Statistical analysis of behavioral task and self-report data using Excel and SPSS.
- Assisting with pre-processing and first-level analysis of neuroimaging data using the Matlab-based program Statistical Parametric Mapping (SPM).
- Assisting with the preparation of manuscripts and conference poster presentations.
- Mentoring and training undergraduate research assistants in data management, statistical analysis, and interpretation of findings.

PEER-REVIEWED JOURNAL ARTICLES

Benningfield, M. M., Blackford, J. U., **Ellsworth, M. E.**, Samanez-Larkin, G. R., Martin, P. R., Cowan, R. L., & Zald, D. H. (2014). Caudate responses to reward anticipation associated with delay discounting behavior in healthy youth. *Developmental Cognitive Neuroscience*, 7, 43-52.

Williams, M. T., Sawyer, B., Leonard, R. C., **Ellsworth, M.**, Simms, J., & Riemann, B. C. (2015). Minority participation in a major residential and intensive outpatient program for obsessive-compulsive disorder. *Journal of Obsessive-Compulsive and Related Disorders*, 5, 67-75.

CHAPTERS IN EDITED VOLUMES

Williams, M.T., Sawyer, B., **Ellsworth, M.**, Singh, R., & Tellawi, G. (in press). Obsessive-Compulsive Disorder in Ethnoracial Minorities: Attitudes, Stigma, & Barriers to Treatment. In J. Abramowitz, D. McKay, & E. Storch (Eds.), *Handbook of Obsessive-Compulsive Related Disorders, Vol. 1*. Wiley.

MANUSCRIPTS IN PROGRESS

Bayley-Veloso, R., Szabo, Y., **Ellsworth, M.**, & Salmon, P. (revise and resubmit). The proposed role of self-compassion following traumatic stress exposure (submitted to the *Journal of Consulting and Clinical Psychology*).

CONFERENCE POSTERS & ABSTRACTS

Dowell, J., Tellawi, G., **Ellsworth, M.**, Ching, T., Slimowicz, J., Davis, D., & Williams, M. (2016, October). Anxiety, Self-Compassion, Identity, and Social Support in Sexual Minority Individuals. Poster to be presented at the *Association for Cognitive and Behavioral Therapies* conference, New York, NY.

Ellsworth, M., Tellawi, G., Salmon, P. & Williams, M. (2015, November). Psychopathology in Sexual Minorities: The Role of Self-Compassion. Abstract accepted to the *Association for Behavioral and Cognitive Therapies* conference, Chicago, IL.

Ellsworth, M., Tellawi, G., Slimowicz, J., & Salmon, P. & Williams, M. (2015, November). The Intersection between Sexual Minority Identity Development and Religiosity. Abstract accepted to the *Association for Behavioral and Cognitive Therapies* conference, Chicago, IL.

Ellsworth, M., Tellawi, G., Dowell, J., Salmon, P., & Williams, M. (2015, March). The Role of Self-Compassion in Mental Health Outcomes of Sexual Minorities. Poster presented at the *Kentucky Psychological Foundation Spring Academic Conference*, Midway, KY.

Ellsworth, M., Tellawi, G., Slimowicz, J., & Williams, M. (2014, November). Shame, Religiosity, and Internalized Homophobia in Gay and Bisexual Men. Poster presented at the *Association for Behavioral and Cognitive Therapies* conference, Philadelphia, PA.

Jablonski, M. **Ellsworth, M.**, Sephton, S. and Salmon, S. (2014, April). The Relationship Between Dispositional Mindfulness and Eating: An Analysis of Self-Reported and In-Vivo Eating Behaviors in Undergraduate Females. Poster presented at the meeting for the *12th Annual International Scientific Conference for Clinicians, Researchers and Educations* ("Investigating and Integrating Mindfulness in Medicine, Healthcare and Society"), Norwood, MA.

Benningfield, M. M., **Ellsworth, M. E.**, Blackford, J. U., Martin, P. R., and Cowan, R. L. (2012, October). Greater fMRI activation of limbic regions during presentation of immediate versus delayed rewards in healthy 10-14 year olds. Poster presented at the meeting for the *American Academy of Child and Adolescent Psychiatry*, San Francisco, CA.

Benningfield, M. M., **Ellsworth, M. E.**, Blackford, J. U., Martin, P. R., and Cowan, R. L. (2012, June). Discounting of future rewards and brain activation in healthy 10-14 year-olds. Poster presented at the meeting for the *College on Problems of Drug Dependence*, Palm Springs, CA.

Benningfield, M. M., **Ellsworth, M. E.**, Blackford, J. U., Martin, P. R., and Cowan, R. L. (2012, May). Discounting of future rewards and brain activation in healthy 10-14 year olds. Poster presented at the meeting for the *Society for Biological Psychiatry*, Philadelphia, PA.

INVITED AND DEPARTMENTAL TALKS

Ellsworth, M. & Tellawi, G. 'Understanding LGBT Mental Health Concerns.' LGBT Health and Wellness Competency Certificate Program, Health Sciences Center, University of Louisville School of Medicine, Louisville, KY (October 12, 2015).

Monsma, B. & **Ellsworth, M.** 'Psychological Perspectives, Tips, and Techniques for Working with Patients Suffering with Chronic Pain.' Pain Management Conference, Frazier Rehab Institute, Louisville, KY (April 16, 2015)

Ellsworth, M., Tellawi, G., & Sawyer, B. 'Mental Health Issues in LGB Populations: Minority Stress, the Coming Out Process, and LGB-Sensitive Therapy.' Department of Psychological and Brain Sciences, University of Louisville, Louisville, KY (April 7