EXPLORING THE RELATIONSHIP BETWEEN PAIN AND EMOTION REGULATION IN OLDER ADULTS

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Abstract

The link between pain and emotion is well documented. Emotional Regulation (ER) is a process for monitoring, evaluating, and altering emotional reactions. In engaging in ER, individuals may rely on reappraisal or suppression. Suppression, in contrast to reappraisal, increases symptoms of anxiety and decreases positive mood. Complicating the emotion-pain dynamic are pain-related responses (e.g., catastrophic thinking about pain) that may vary as a function of age and gender. Some support exists for gender differences with respect to ER and mood but research on ER and older persons with chronic pain is still lacking. The prevalence of pain in older adults ranges from 25-56%. Investigations of emotion in older adults with pain have been limited to those with acute pain. Only one ER and pain study has included older adults, albeit with acute pain. Further investigation in this area is hampered by the absence of psychometric data for established ER questionnaires for use with older adult populations. This study investigated the psychometric properties of the Emotion Regulation Questionnaire (ERQ) for use with older adults. Following validation of the ERQ, the questionnaire was then administered to a sample of older and younger adults with chronic pain along with other tools to study the expected mediating role of ER in the experience of chronic pain. Neither ER strategy (i.e., suppression, reappraisal) fully mediated the hypothesized relationships between pain outcomes (i.e., fear of pain, pain intensity) and pain catastrophizing. Despite this, the findings from this study support the positive association between suppression of emotions with fear of pain, pain catastrophizing, and pain intensity. Contrary to expectation, reappraisal strategy was not inversely predictive of fear of pain, pain catastrophizing, or pain intensity. Exploratory analyses of possible
gender and age differences in ER revealed that reappraisal was unrelated to age and
gender. A main effect for gender was found for suppression, with males reporting higher
use of this strategy in comparison to females. Younger adult males also reported more
suppression and reappraisal as compared to their older adult male counterparts. The
findings have implications for future chronic pain investigations and interventions. Study
limitations are also discussed.
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Dedication

This dissertation and doctoral degree could not have been achieved without the unwavering support and love of a single person, my wife and best friend, Pardis Onvani. Thank you for all the late nights, long chats, and positivity even during the most difficult of times while I grappled with completing this project. I am truly blessed that you are a part of my life, and words cannot express how excited I am to explore what the future holds for us.

Love is not written on paper, for paper can be erased. Nor is it etched on stone, for stone can be broken. But it is inscribed on a heart and there it shall remain forever.

~ Rumi (13th Century Persian Poet and Scholar)
# Table of Contents

Abstract i
Acknowledgements iii
Dedication iv
Table of Contents v
List of Tables x
List of Figures xi
Introduction 1
  Overview 1
  The Nature of Pain 4
  The Gate Control Theory of Pain 5
    The Neuromatrix Model of Pain 7
  Biopsychosocial Models of Pain 8
  Theoretical Overview of Emotions 9
    Negative Emotional Response to Pain 13
      Fear Avoidance Model of Pain 15
        Pain Catastrophizing 17
          Other Psychological Factors Influencing Pain 22
  Emotion Regulation 24
    Process Model of Emotion Regulation 25
      Cognitive Reappraisal and Emotional Suppression 26
    Measurement of Emotion Regulation 28
      Psychosocial Outcomes of Emotion Regulation 32
Study 2: Hypotheses

Study 2: Methods

Participants

Procedure

Measures

- Shortened Version of the Fear of Pain Questionnaire – III
- McGill Pain Questionnaire Short Form
- Pain Catastrophizing Scale

Analyses

Study 1: Results

- Missing Data, Outliers, and Distribution Analyses
- Demographic Analyses
- Internal Consistency and Item Analysis
- Convergent and Discriminant Validity

Study 2: Results

- Missing Data and Outliers
  - Data Distribution and Normality
- Tests of Hypothesized Relationships
  - Prediction of Pain Catastrophizing
  - Emotion Regulation and Pain-Related Outcomes
- Emotion Regulation and Age/Gender Differences
  - Reappraisal and Age/Gender Differences
  - Suppression and Age/Gender Differences
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tests of Hypothesized Mediation Effects</td>
<td>84</td>
</tr>
<tr>
<td>Reappraisal as a Mediator for Older Adult Pain Experiences</td>
<td>85</td>
</tr>
<tr>
<td>Suppression as a Mediator for Older Adult Pain Experiences</td>
<td>85</td>
</tr>
<tr>
<td>Reappraisal as a Mediator for Younger Adult Pain Experiences</td>
<td>88</td>
</tr>
<tr>
<td>Suppression as a Mediator for Younger Adult Pain Experiences</td>
<td>90</td>
</tr>
<tr>
<td>Discussion</td>
<td>94</td>
</tr>
<tr>
<td>Validity of the Emotion Regulation Questionnaire</td>
<td>95</td>
</tr>
<tr>
<td>Prediction of Pain Catastrophizing</td>
<td>97</td>
</tr>
<tr>
<td>Positive Predictors of Pain Catastrophizing</td>
<td>98</td>
</tr>
<tr>
<td>Age and Pain Catastrophizing</td>
<td>99</td>
</tr>
<tr>
<td>Emotion Regulation and Other Predictors of Pain-Related Outcomes</td>
<td>99</td>
</tr>
<tr>
<td>Emotion Regulation as a Predictor of Mood and Anxiety</td>
<td>102</td>
</tr>
<tr>
<td>Influence of Emotion Regulation on Gender and Pain-Related Factors</td>
<td>104</td>
</tr>
<tr>
<td>Impact of Emotion Regulation on Pain Duration and Pain-Related Outcomes</td>
<td>105</td>
</tr>
<tr>
<td>Influence of Emotion Regulation on Age as a Predictor of Pain-Related Outcomes</td>
<td>106</td>
</tr>
<tr>
<td>Emotion Regulation Age and Gender Differences in Chronic Pain Populations</td>
<td>107</td>
</tr>
<tr>
<td>Mediating Effects of ER Strategy on the Pain Experience</td>
<td>111</td>
</tr>
<tr>
<td>Study Limitations</td>
<td>113</td>
</tr>
<tr>
<td>Future Directions</td>
<td>115</td>
</tr>
<tr>
<td>Conclusions</td>
<td>117</td>
</tr>
<tr>
<td>References</td>
<td>121</td>
</tr>
<tr>
<td>Appendix A: Research Ethics Board Certificate of Approval</td>
<td>157</td>
</tr>
<tr>
<td>-------------------------------------------------------------</td>
<td>-----</td>
</tr>
<tr>
<td>Appendix B: Study 1 Consent Forms</td>
<td>158</td>
</tr>
<tr>
<td>Appendix C: Study 2 Consent Form</td>
<td>166</td>
</tr>
<tr>
<td>Appendix D: Demographic Questionnaire</td>
<td>170</td>
</tr>
</tbody>
</table>
List of Tables

Table 1. Scale Scores and Independent T-Tests Comparing Online Versus Paper and Pencil Participant Responses Across Different Measures 69

Table 2. Study 1 Participant Demographic Characteristics 72

Table 3. Study 2 Scale Scores for Older and Younger Adult Participants 73

Table 4. Correlation Matrix for the McGill Pain Questionnaire Short Form and the Shortened Version of the Fear of Pain Questionnaire – III 75

Table 5. Pain Catastrophizing Scale Regression Results with all Hypothesized Demographic Predictors 76

Table 6. McGill Pain Questionnaire Short Form and Pain Catastrophizing Scale Regression Results with Demographic and Emotion Regulation Predictors 78

Table 7. Shortened Version of the Fear of Pain Questionnaire – III and Center for Epidemiological Studies – Depression Scale Regression Results with Demographic and Emotion Regulation Predictors 79

Table 8. Penn State Worry Questionnaire – Abbreviated Regression Results with Demographic and Emotion Regulation Predictors 80

Table 9. Summary of All Mediation Model Results Tested For Older and Younger Adults 92
List of Figures

Figure 1. Representation of Emotion Regulation Suppression Mediation Models 64

Figure 2. Representation of Emotion Regulation Reappraisal Mediation Models 65

Figure 3. Older Adult Representation of the Relationship between 1) Fear of Pain, 2) Sensory Dimensions of Pain Intensity, 3) Affective Dimensions of Pain Intensity and Pain Catastrophizing Mediated through Emotional Regulation Reappraisal Strategy 86

Figure 4. Older Adult Representation of the Relationship between 1) Fear of Pain, 2) Sensory Dimensions of Pain Intensity, 3) Affective Dimensions of Pain Intensity and Pain Catastrophizing Mediated through Emotional Regulation Suppression Strategy 87

Figure 5. Younger Adult Representation of the Relationship between 1) Fear of Pain, 2) Sensory Dimensions of Pain Intensity, 3) Affective Dimensions of Pain Intensity, and Pain Catastrophizing Mediated through Emotional Regulation Reappraisal Strategy 89

Figure 6. Younger Adult Representation of the Relationship between 1) Fear of Pain, 2) Sensory Dimensions of Pain Intensity, 3) Affective Dimensions of Pain Intensity, and Pain Catastrophizing Mediated through Emotional Regulation Suppression Strategy 91
Introduction

Overview

This study has two main goals. The first objective is to examine the psychometric properties of the widely used Emotion Regulation Questionnaire (ERQ: Gross & John, 2003) in an older adult population. The second objective is to investigate the relationship between chronic pain and two specific emotion regulation (ER) processes (i.e., suppression and reappraisal). ER is the process of monitoring, evaluating, and altering emotional reactions (Thompson, 1994). Individuals differ in their ER strategies. That is, they may rely on either reappraisal or suppression of thoughts when they regulate their emotions (Gross & John, 2003). Reappraisal involves changing the way one thinks about an emotional event, while suppression involves inhibiting ongoing emotion-expressive behaviour (e.g., Gross & John, 2003). ER strategies are particularly important in relation to pain because persistent pain can result in negative self-perception and feelings (e.g., Hadjistavropoulos et al., 2011; Ramage-Morin, 2008). Left unaddressed, these negative feelings can be compounded by other unpleasant pain-related processes (e.g., fear of pain, catastrophizing about pain) that often vary as a function of age (e.g., Cook, Brawer, & Vowles, 2006; Ruscheweyh, Nees, Marziniak, Evers, Flor, & Knecht, 2011) and gender (Sullivan, Tripp, Rodgers, & Stanish, 2000; Sullivan, Tripp, & Santor, 2000). For example, Ruscheweyh and colleagues (2011) determined that while catastrophizing in general did not differ between age groups, in younger adults, pain catastrophizing measured directly following noxious stimulation (i.e., non-dispositional or situationally specific catastrophizing) was associated with emotional responses to pain, whereas in older adults it was associated with pain intensity. Sullivan, Tripp, Rodgers and
colleagues (2000) found that males reported less pain than females and catastrophizing accounted for the differences in pain perception between men and women. In other words, evidence suggests that managing negative pain-related emotional experiences through the use of appropriate ER strategies can be an effective strategy in mitigating unpleasant pain-related outcomes (e.g., Burns, Quartana, Gilliam, Matsuura, Nappi, & Wolfe, 2012). While support exists for gender and age differences with respect to ER and mood, it remains to be determined what the underlying causes of these differences are (e.g., Nolen-Hoeksema & Aldao, 2011). This study investigated gender and age differences with respect to ER suppression and reappraisal. Despite our limited understanding of how gender and age variables affect ER, some clearer trends have been established in ER research. For example, it is widely accepted that regardless of gender or age, emotional suppression in contrast to reappraisal, increases physiological symptoms of anxiety and decreases positive mood (Campbell-Sills, Barlow, Brown, & Hofmann, 2006a). Negative emotion (e.g., anger) suppression is linked to higher clinically relevant pain symptom reporting in a sample of middle-aged chronic pain patients (e.g., Burns et al., 2012).

The prevalence of pain in community dwelling older adults ranges from 25-56% (American Geriatric Society, 2002). Investigations of emotions in relation to older adults with pain have generally been limited to those who experience acute pain (e.g., Paquet, Kergoat, & Dubé, 2005). The findings with regards to these types of investigations are limited in that, unlike this study, homogeneous samples of convenience are often derived from hospital or acute care settings only (e.g., Paquet et al., 2005), which significantly hinder the generalizability of the results. Besides limited sampling
strategies, another area that has made investigating ER within older adult populations difficult is the overwhelming lack of validated ER measures for use within this population. Given the lack of validated tools, ER in older adults has been operationalized as simple fluctuations in mood levels and many researchers accept such changes in mood as evidence for ER activity (e.g., Agar-Wilson & Jackson, 2012; Connelly et al., 2007; Paquet et al., 2005). To date, no investigation has been completed with regards to the emotion-chronic pain dynamic with a particular focus on comparing male and female older adults across ER and other related processes (Koechlin, Coakley, Schechter, Werner, & Kossowsky, in press). This study is the first to exclusively examine psychometric properties of a widely used measure of ER in older adults. It is also the first study designed to specifically investigate the relationship between chronic pain outcomes (i.e., fear of pain, pain intensity, and pain catastrophizing) and two specific ER processes (i.e., suppression and reappraisal) in community dwelling older adults and their younger adult counterparts simultaneously. The study design will further allow for the construct validation of a widely used ER measure (ERQ: Gross & John, 2003) in older adult samples. As part of this study, differences between male and female older adults (65+ years) and younger adults (35 years or younger) living with chronic pain were investigated in order to better understand the mechanisms by which these ER differences occur. In addition to exploring demographic differences, this study aimed to replicate limited results from previous studies demonstrating gender (e.g., Balzarotti, John, & Gross, 2010; Burns, Elfant, & Quartana, 2010) and age differences (e.g., Gross & John, 2003; Nolen-Hoeksema & Aldao, 2011) with regard to ER and chronic pain. For example, it is yet to be determined if older adults are better able to manage their chronic
pain, fear of pain, and possible pain catastrophizing (by engaging in reappraisal strategies over suppression strategies) as compared to their younger adult counterparts (or vice versa). Results from this study provide potentially valuable information that could have implications for future treatment strategies geared towards addressing chronic pain and its related outcomes in both younger and older adult populations.

The Nature of Pain

The earliest conceptualizations of pain documented as far back as 4000 BC failed to incorporate the role of emotions with respect to the experience of pain. Nullifying the role of emotions during the pain experience was evident during the 17th century. For instance, René Descartes’ (1664/1972) popular dualistic view of the human body conceptualized pain much the same way as a machine is studied today (Gatchel, 1999; Melzack & Katz, 2004). Descartes argued that the human mind and soul formed a separate entity that was incapable of directly effecting physical matter or somatic processes in a meaningful way (Gatchel, 1999). Modern conceptualizations of pain suggest that it is a complex psychological and physical experience that must incorporate emotions. Descartes overlooked this important aspect and his overly simplistic theory viewed pain as a direct result of some external stimulus (e.g., fire) acting on the body as a force. In contrast to the International Association for the Study of Pain (IASP) which defines pain “as an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (International Association for the Study of Pain, 2011, “IASP Taxonomy,” para. 5); Descartes neglected any possible role for psychological factors in the pain experience, which in turn would suggest that pain can only be addressed successfully through a biomedical approach, a
belief that is widely recognized as being untrue (e.g., Hadjistavropoulos et al., 2011). Today, his outdated views fail to explain the well documented lack of direct one-to-one correspondence between the intensity of the pain experience and the extent of tissue damage (Hadjistavropoulos et al., 2011; Hadjistavropoulos & Craig, 2004; Melzack & Katz, 2004). Moreover, Descartes’ views fail to explain the potential positive and negative roles ER strategies can play with respect to pain (Burns et al., 2012). To put it another way, Descartes’ view of pain failed to emphasize not only the sensory but also the emotional aspects of pain.

The limitations of Descartes’ views influenced practice for many years, and he was not the only popular theorist to fail at explaining the pain experience in its entirety. In 1895, Von Frey refined Descartes’ understanding of pain and described the specificity theory of sensation, suggesting that injury activates pain-specific receptors and fibres, which then project impulses through a direct spinal pathway to a pain centre located in the brain (Melzack & Katz, 2004). While this was a more complex understanding of pain in comparison to Descartes it is still considered as oversimplified by modern standards (Hadjistavropoulos et al., 2011; IASP, 2011). These overly simplified conceptualizations of pain in the first half of the 20th century resulted in many individuals being labelled as “psychologically disturbed” as well as being deprived of proper treatment and care (Melzack & Katz, 2004).

**The Gate Control Theory of Pain**

In order to understand the theoretical basis for this study, specifically, the relationship emotions and ER have with the pain experience, it is critical that a more comprehensive and empirically supported theory of pain be explored. The gate control
theory (Melzack & Wall, 1965) was the first major pain theory to emphasize the relationship between psychological and physiological processes and the experience of pain (Gatchel, 1999). By doing so, Melzack and Wall (1965) proposed a theory that recognized the influence of psychological factors such as emotions in the pain experience. More specifically, they argue gating mechanisms within the dorsal horn of the spinal cord are responsible for allowing or blocking the passage of ascending nociceptive information from the periphery to the brain. According to Melzack and Wall (1965), the amount of excitatory activity in the spinal cord transmission cells influences the gating mechanisms. Specifically, excitation occurring along the large-diameter myelinated fibres (that transmit non-nociceptive sensory messages) results in the gate closing, while excitation along the smaller non-myelinated fibres translates in the gate opening. Furthermore, the path of pain is not purely unidirectional (i.e., from the periphery to the brain). Instead descending transmissions from the brain (e.g., resulting from cortical activity related to cognitive/attentional and emotional processes) also influence the gating mechanism by opening or closing the pain gate. The subsequent summation of information from the ascending and descending fibres plays a vital role in determining if the gate is open or closed, influencing the perception of pain (Melzack & Wall, 1965). Simply put, when the gate is opened, pain messages pass through more easily and pain can and often is experienced more intensely. The opposite is true when the gate is closed and pain may not even be experienced (Melzack & Wall, 1965). While understanding the role of the gating mechanisms within the theory is important, cognitive influences on the perception of pain are also highly relevant to the theory. According to the gate control theory, “downward” central nervous system mediation can play a
potentially significant role in both positive (e.g., coping behaviour) or negative pain (e.g., catastrophizing) perception, which further establishes the role of cognition and psychological processes in pain mediation (Gatchel, 1999).

**The neuromatrix model of pain.** While the gate control theory of pain has many strengths, in part because it recognized the role of psychological processes in the experience of pain, it was not without limitations. Specifically, the experience of phantom limb pain could not adequately be explained through the gate control theory because direct sensory input evoked by injury and related pathology could no longer take place after the severing of the limb (Melzack, 2001). The neuromatrix model which was developed as a supplement to the gate control theory attempted to address this theoretical gap. According to Melzack (1989), the brain includes a body-self neuromatrix meaning it is comprised of sensory, affective, and cognitive neuromodules (Melzack & Katz, 2004). In essence, the neuromatrix can be conceptualized as a widespread neuronal distribution throughout the brain that generates patterns, processes information that flows through it, and ultimately produces the perception of the sensation that is felt in the body even after the removal of the limb. According to the model the neuromatrix can produced painful experiences such as phantom limb pain in the absence of external stimulation.

The combined neuromatrix model and gate control theory are widely accepted explanations for the experience of pain. The gate control theory of pain has received extensive research support from physiological and psychological investigations (e.g., Humphries, Johnson, & Long, 1996; Pohl et al., 1992). The idea that ER processes, which constitute the focus of this research study, can impact the pain experience both
positively and negatively is consistent with the gate control theory and its explanation about the role of psychological factors (e.g., emotions) in pain.

**Biopsychosocial Models of Pain**

Turk and Okifuji (2002) note that biopsychosocial perspectives view illness as a dynamic and reciprocal interaction among biological (e.g., disease substrates), psychological (e.g., emotions), and sociocultural variables (e.g., interpersonal relationships) that shape the person’s response to pain. Biopsychosocial conceptions of pain are consistent with the gate control theory and elaborate on the role of psychosocial influences in the pain experience. This study aims to explore how such variables (e.g., emotional coping, relationship status) can influence chronic pain outcomes such as pain catastrophizing, fear of pain, and pain intensity as well as whether specific demographic factors (i.e., age, gender) play an influential part with regards to ER strategies used in managing pain-related distress. As such situational, intrapersonal (e.g., the potential role of ER), and interpersonal (which may also include contextual aspects) factors can influence the extent to which a sufferer’s pain demonstrates itself socially leading to a behavioural expression of pain (Hadjistavropoulos et al., 2011). For example, an older adult may attempt to demonstrate stoicism and suppress (both cognitively and behaviourally) his or her pain in order to appear less burdensome to his or her caregivers (Cook & Chastain, 2001; Jones, Fink, Clark, Hutt, Vojir, & Mellis, 2005; Martin, Williams, Hadjistavropoulos, Hadjistavropoulos, & MacLean, 2005). Many older adults cope in such a manner because they falsely view pain as a natural and unavoidable part of aging that should be endured and tolerated (Cheng et al., 2017). Complicating the intrapersonal and interpersonal factors that influence pain are a host of psychological and
more specifically emotional concerns (e.g., sadness, anger) that can present along with poorly managed pain. In particular, unmanaged pain is commonly associated with interpersonal relationship difficulties (e.g., Burns et al., in press), negative self-perception and feelings (e.g., Hadjistavropoulos et al., 2011; Ramage-Morin, 2008), as well as depression, anxiety, decreased socialization, and sleep disturbance (e.g., Hadjistavropoulos and Craig, 2004, Lumley et al., 2011). This suggests that the administration of analgesic drugs, which is the most popular approach for the treatment of pain in older adults (American Geriatric Society, 2002), is not sufficient and investigations in line with the aims of this study may further our current understandings of pain assessment and treatment within this population. In sum, biopsychosocial models provide an integrated approach that incorporates purely mechanical and physiological processes as well as psychological and social-contextual variables that may cause and perpetuate pain (Engel, 1977; Hadjistavropoulos et al., 2011; Waddell, 1987; see also Asmundson & Wright, 2004; Gatchel, 1999; Turk & Okifuji, 2002).

**Theoretical Overview of Emotions**

Our understanding about the role psychological factors have on pain has only evolved within the last century (see Melzack & Wall, 1965). This is not surprising given that our understanding of emotions in general has taken shape within the last century as well (e.g., Cannon, 1931). For many, emotions are states elicited by rewards and punishment (e.g., Rolls 1990). Early theories of emotions did not adequately fit with our current conceptualizations of pain because they over-emphasized physiological factors as being critical in eliciting emotions thus minimizing the role of cognition. For example, the James-Lange theory posited that emotions are not directly influenced or caused by the
perception of some event, but rather by the specific physiological response within our body to that event (James, 1884). This theory was unsupported when it became evident, through experimentation that animals whose brain activities were severed from their spinal cords (and thus unable to process bodily sensations) were still able to elicit emotions. This ability to bring forth emotions in an unaltered manner without the brain sending and receiving information about bodily sensations is contrary to James’ (1884) postulations (Cannon, 1931). This is significant because it suggests that both physical and cognitive factors influence the experience of emotions. Any treatment approach focusing purely on the physical aspects of pain may not be as effective as strategies that focus on both emotional and physical dimensions. This lends further credibility for the need to explore the influence ER may or may not have on pain, particularly in older adult populations in which more than half may be living with chronic pain (American Geriatric Society, 2002) all the while underreporting their emotional distress (e.g., Abdulla et al., 2013; Cornally & McCarthy, 2011).

Schachter and Singer (1962) later challenged the unidimensional physiological approach (e.g., James 1884) through the addition of a cognitive perspective by suggesting that in order for emotions to be elicited, physiological arousal must precede it. According to Schachter and Singer (1962), once a person is able to decipher the reason behind this physiological arousal he or she can then experience and label it as an emotion. While this approach was an improvement with respect to the unidimensional physiological approach (e.g., James 1884), it was still limiting in that emotions could not exist in the absence of physiological sensations (Schachter & Singer, 1962). Nonetheless, the cognitive theory put forth by Schachter and Singer (1962) gave way to more recent psychological
perspectives of emotions. Solomon and Corbit (1974) suggested that the experience of an emotion can be considered an equilibrium of counteracting emotions. When an individual experiences one emotion, he or she is able to suppress the opposite emotion (e.g., pleasure suppresses pain and vice versa). Eventually, an initial emotional reaction will subside and it is at this point that we begin to experience the opposing emotion in order to restore the delicate equilibrium between the two emotions (Solomon & Corbit, 1974). Unlike previous theories, Solomon and Corbit’s (1974) perspectives no longer required a physiological experience or symptom to precede the experience of emotions. This is one of the earliest theories that accounted for the possibility of ER taking place. Despite this, Solomon and Corbit (1974) views also suggest that individuals are always struggling to remain in a delicate state of emotional balance trying to avoid negative emotions in favour of positive ones.

To date, consensus on the specific influences and mediators of emotions has not been reached (e.g., see Pell, Paulmann, Dara, Alasseri, & Kotz, 2009 for a discussion on how language influences emotions as well as MacLean, 1993 for a review on the role of the limbic system with regard to emotions). Currently, popular modern cognitive-appraisal theories suggest that much of the cognitive process involved in the elicitation of emotion occurs outside awareness, or can otherwise be considered automatic (e.g., Scherer, 2001). Moreover, cognitive-appraisal theories place the cognitive component at the onset of the emotional episode (prior to physiological response). This view gives more credit to the influence of the overall cognitive processes in determining which stimuli can lead to an emotion and which cannot as well as the strength and type of emotion that should be produced (Moors, 2009). Unlike ideas associated with the
original Schachter-Singer theory (Schachter & Singer, 1962), conscious attribution of the emotion occurs after the emotion has been elicited (Moors, 2009). Even with the evolving research on emotions, methodological uncertainties and disagreements over the most effective theoretical perspective for capturing emotional states continues to hamper investigations (Lench, Flores, & Bench, 2011). More recent perspectives suggest that discrete emotions or “core” emotions (e.g., happiness) should be the main focus of investigation. Discreet emotion models, which are not universally accepted, indicate that core emotions (i.e., happiness, surprise, sadness, anger, disgust, contempt, and fear) transcend ethnic and cultural boundaries in that they are universal to all humans and can elicit changes in cognition, judgement, experience, behaviour, and physiology (Lench et al., 2011). Contrary to unidirectional cognitive-appraisal beliefs, theorists differ on exactly what responses emotions can elicit, with some suggesting that emotions can elicit approach-avoidance behaviours, while others for example argue that they act primarily upon physiological arousal (Lench et al., 2011).

In the pain experience and consistent with the aims of this present study, emotions are complex states of physiological arousal and awareness that can serve as action dispositions (Chapman, 2004). For Chapman (2004), pain itself has strong emotional components and poses a threat to biological, psychological, and/or social integrity of an individual. Pain is not a single affective state, but part of a “family”, in that variations in pain or pain-like experiences generally produce similar emotional states and expressions such as the squinting of the eyes (Ekman, 1992). This perspective accounts for some of the factors that contribute and influence pain, making the experience unique for each
individual. As such, it is fitting with biopsychosocial perspectives on pain (e.g., Hadjistavropoulos, 2011).

**Negative emotional response to pain.** Physiological indicators suggest that the affective dimensions of pain primarily involve a two-stage mechanism (Chapman, 2004). This mechanism generates an instantaneous experience consistent with a response to a threat (e.g., fear or hypervigilance). Such a rapid response can serve to protect by disrupting attention and/or behaviour (Chapman, 2004). As part of this response limbic structures in the brain begin to excite the autonomic nervous system, which then activate commonly associated bodily states such as cardiac function, muscle tension, and increased respiration (Chapman, 2004). The awareness of activated bodily states can further create a strong negative subjective experience, and this awareness is the second mechanism of the affective dimension of pain (Chapman, 2004). ER strategies such as those investigated in this study specifically target this second mechanism (e.g., Paquet et al., 2005). Consistent with this, Hale and Hadjistavropoulos (1997) demonstrated that non-verbal expression of negative emotion and pain increased directly in response to a painful stimulus. Both objective and subjective ratings revealed that distinct expressions of disgust, anger, and fear increased while happiness decreased during a painful event when compared to baseline segments. What is less clear is whether masking the negative emotions through suppression will have the same detrimental effect. While observers may have difficulty noticing negative emotions that are suppressed, researchers note that reappraisal of negative emotions is more effective than mere suppression in the individual experiencing the negative emotion (Gross & John, 2003). This study attempted to add further empirical evidence to this claim.
While the relationship between pain and negative emotional consequences has been established (e.g., Burns et al., 2012; Chapman, 2004; Hale & Hadjistavropoulos, 1997), the emotional consequences of chronic pain may be even more limiting than once thought. Besides experiencing negative emotional states, Apkarian and colleagues (2004) concluded that chronic pain patients are impaired on decision-making tasks as well. Unlike the control participants, pain patients failed to adopt a more efficient emotional decision making pattern on a task that involved undertaking gambling choices during a card game, which would result in a more profitable outcome. Furthermore, Baker and colleagues (2016) found that individuals living with chronic pain were more likely to report experiencing limitations in executive functioning in addition to clinically relevant deficits with regards to working memory and emotional control (i.e., the ability to regulate emotional responses) when compared to the general population. This may be in part owing to organic brain changes that have recently been reported with chronic pain populations (e.g., Ng et al., 2018). Ultimately this may suggest that chronic pain patients may also make poorer ER strategy choices in comparison to their non-pain counterparts. It is yet to be determined if individuals in chronic pain rely on maladaptive strategies such as suppression more regularly in the face of emotional distress. An investigation of experimentally-induced acute pain showed no advantageous difference between reappraisal and suppression choice during noxious stimulation (Hampton, Hadjistavropoulos, Gagnon, Williams, & Clark, 2015). This is a specific question that this study investigated in chronic pain older and younger adult populations. In sum, individuals with chronic pain may rely on maladaptive ER strategies due to disrupted decision making commonly found to be associated with their health condition (Apkarian
et al., 2004; Verdejo-Garcia, Torrecillas, Calandre, Delgado-Rodriguez, & Bechara, 2009; Walteros et al., 2011)

**Fear-avoidance model of pain.** Biopsychosocial models have been instrumental in bringing attention to the multifaceted nature of the pain experience. Given this, it is not surprising that over the past two decades a renewed interest in the relationship between pain and emotions has began to form (e.g., Burns et al., 2012, Fine, 2011; Keefe et al., 2001; Linton, 2005). Many individuals living with chronic pain experience negative long-term effects such as unwanted emotional reactions including fear and anxiety (Fine, 2011). Such unwanted consequences can negatively impact the quality of life some individuals experience. This detrimental impact is often more pronounced for older adults (American Geriatric Society, 2002). Through the use of validated measures, this study further explored the relationship between pain and emotions, as well as strategies used to manage negative emotional reactions to pain. One area that this study is influenced by theoretically is the fear-avoidance model of pain which is an empirically supported (e.g., Asmundson, Parkerson, Petter, & Noel, 2012; Crombez, Eccleston, Van Damme, Vlaeyen, & Karoly, 2012) biopsychosocial formulation that attempts to explain why the negative emotional and sensory components of pain become desynchronous. Thus, the various conceptualizations of fear-avoidance are aimed at addressing the reasons behind the fear emotion and avoidance behaviour persisting even after the presence of tissue damage (Asmundson & Wright, 2004; Lethem, Slade, Troup, & Bentley, 1983; Philips, 1987; Vlaeyen & Linton, 2000). A widely recognized and cited model of fear-avoidance is one that addresses fear-avoidance behaviour for people living with chronic musculoskeletal pain (Vlaeyen & Linton, 2000/2012). This model
postulates that pain experience following an injury is either viewed as nonthreatening or as threatening. When the experience is perceived as threatening (i.e., accompanied by the emotion of fear and anxiety), it may be handled in a maladaptive manner, that may serve to perpetuate a cycle of fear and avoidance (Vlaeyen & Linton, 2000/2012).

Interestingly, Gross and Levenson (1997) as well as Stepper and Strack (1993) demonstrated that reliance on a maladaptive ER strategy such as suppression does not influence the experience of negative emotions. While the research evidence suggests negative emotions cannot be effectively suppressed, it remains unclear if suppression leads to further maladaptive outcomes in older adults with chronic pain (i.e., pain catastrophizing), which this study investigated further in both younger and older adults.

The fear-avoidance model is not without its limitations (e.g., Crombez et al., 2012; Vlaeyen, Crombez, & Linton, 2009; Wideman et al., 2013). For instance, while investigations suggest that aspects of the fear-avoidance of pain model hold true experimentally, these findings are not consistently obtained in clinical research (Bergbom, Boersma, & Linton, 2012; Pincus, Smeets, Simmonds, & Sullivan, 2010). Some research findings indicate that task persistence (i.e., the opposite of avoidance) despite injury, can exacerbate pain (e.g., Crombez, Vervaet, Lysens, Baeyens, & Eelen, 1998; Hasenbring & Verbunt, 2010) which this model fails to account for. One common pathway by which the fear-avoidance model is conceptualized is that for certain individuals prolonged pain is interpreted in a catastrophic way giving rise to behavioural avoidance and pain-related fear (Westman, Boersma, Leppert, & Linton, 2011). Consistent with Westman and colleagues (2011), fear-avoidance models are typically viewed in a similar fashion to cognitive-behavioural conceptualizations of
psychopathology (Crombez et al., 2012). While fear-avoidance beliefs can be viewed as irrational responses to an otherwise normal pain situation, it is more likely that pain is the abnormal situation to which individuals respond in a normative and culturally consistent manner (Crombez et al., 2012). This view is supported by Wideman and colleagues (2013) who suggest that while the fear-avoidance model does well to capture cognitive-behavioural dimensions of pain-related fear, the model could benefit from incorporating social, cultural, and environmental dimensions to go along with the different resilience, physiological, and behavioural processes addressed within the model. The addition of sociocultural influences would be more in line with the full biopsychosocial nature of pain (Wideman et al., 2013). Even so, the fear-avoidance model provides a theoretical rationale for why some individuals living with chronic pain chose maladaptive strategies (i.e., suppression) for managing their pain.

**Pain catastrophizing.** The term “catastrophizing” was first introduced by Ellis (1962) and further elaborated upon by Beck (1979) to describe maladaptive cognitive styles within individuals diagnosed with anxiety and depressive disorders, who may engage in negative foreshadowing. This negative anticipation has translated over to pain catastrophizing conceptualizations, and it is within this framework that catastrophizing can act as a mediator between pain and the negative emotional distress often associated with it (e.g., Sullivan, Rodgers, & Kirsch, 2001). To date no investigation has examined whether specific ER strategies could be relied upon by older adults to mediate the relationship between aspects of the pain experience (pain intensity, fear of pain) and negative emotional consequences associated with pain (e.g., catastrophizing). This study addressed this limitation in the literature. Catastrophizing is one possible outcome of the
previously described fear-avoidance model of pain (e.g., Westman et al., 2011) which this study investigates.

Pain catastrophizing has been broadly conceived as an exaggerated negative “mental set” that is brought to bear during actual or anticipated pain experience (Sullivan, Thorn et al., 2001). In addition, catastrophizing is a multidimensional construct comprising elements of rumination, magnification, and helplessness (Sullivan, Bishop, & Pivik, 1995; Sullivan, Rodgers et al., 2001). An individual’s beliefs about pain are significantly associated with catastrophizing (e.g., Turner, Jensen, & Romano, 2000). Even so, pain beliefs are generally viewed as being stable, suggesting that catastrophizing may also refer to an unwavering construct (Turner & Aaron, 2001). Nonetheless, some researchers have demonstrated that pain beliefs can be amenable to change (e.g., Ghandehari et al., 2013). Catastrophizing is consistently associated with heightened pain experiences across various pain-related conditions such as dental procedures, rheumatoid arthritis, and low back pain (Sullivan, Thorn et al., 2001). In addition, pain catastrophizing has been associated with sleep disturbance (Buenaver et al., 2012) as well as perceived pain intensity, disability, and psychological distress (e.g., Ruscheweyh, et al., 2011; Severijns, Vlaeyen, van den Hout, & Weber, 2001; Sullivan, Rogers et al., 2001). In non-chronic pain undergraduate student samples undergoing a cold pressor task (CPT; in which participants were asked to submerge their hand in ice water in order to induce pain), catastrophizing was significantly correlated with expectancies for emotional distress as well as actual emotional distress (Sullivan, Rodgers et al., 2001). In theory, this suggests emotional distress and catastrophizing can both be reduced simultaneously by engaging in an appropriate ER strategy such as reappraisal. A unique
aim of this study is to test this relationship using a validated ER measure with an older adult population.

While some investigations have provided evidence in support of the relationship between catastrophizing and emotions (e.g., Sullivan, Rodgers et al., 2001), other studies involving non-chronic pain undergraduate students have not found such support (Bartley & Rhudy, 2008). Bartley and Rhudy (2008) investigated undergraduate students receiving electrical stimulation who simultaneously viewed erotic, neutral, or unpleasant imagery and ultimately found no evidence that catastrophizing relates to affective reactions. However, pleasure ratings were highest for erotic pictures and lowest for unpleasant imagery, and arousal was higher during erotic and attack pictures relative to neutral images. These findings were similar across all levels of pain catastrophizing, which lead Bartley and Rhudy (2008) to conclude that catastrophizing did not influence nociceptive reactions (i.e., nociceptive flexion reflex, skin conductance response, heart rate acceleration, subjective pain). Caution is warranted when interpreting these findings since by choosing to only assess the helplessness component of catastrophizing, Bartley and Rhudy (2008) did not account for the multidimensional nature of pain catastrophizing. In this study, the multidimensional nature of catastrophizing was measured, thus addressing a limitation of Bartley and Rhudy’s (2008) investigation. Moreover, as part of this study, further exploration of constructs such as catastrophizing and pain intensity/pain-related fear as possible outcomes of chronic pain was undertaken, thus allowing for examination of them in relation to specific ER strategies. This conceptualization may permit for the determination as to whether or not engaging in certain ER strategies (i.e., reappraisal) can be effective in reducing negative outcomes
associated with the experience of pain. Ong, Zautra, and Reid (2010) lend support for examining catastrophizing as a pain outcome (i.e., dependent variable) in theoretical models. As such, Ong and colleagues (2010) demonstrated that in chronic pain adult populations, more psychologically resilient individuals reported greater positive emotions and exhibited lower levels of daily catastrophizing compared to low-resilient individuals. By treating catastrophizing as an outcome, Ong and colleagues (2010) found that highly psychologically resilient participants also rebounded from daily pain catastrophizing by engaging more readily in the experience of positive emotions. These findings suggest that psychological resilience and positive emotions can be central to the benefits of engaging in appropriate ER processes such as those strategies that encourage re-evaluation (e.g., reappraisal) of negative emotions rather than suppressing or avoiding them altogether (Ong et al., 2010).

Several determinants of pain catastrophizing have been identified. These include differences in gender, age, ethnicity, psychosocial variables, as well as genetic susceptibility and neurophysiological correlates (Leung, 2012). Even so, Ruscheweyh and colleagues (2011) determined that the younger and older adults did not significantly differ with respect to dispositional pain catastrophizing (i.e., pain catastrophizing recalled from memory). However, younger adults reported greater catastrophizing, pain-related anxiety and interference when considering potential pain eliciting situations (e.g., undergoing a dental procedure) as compared to simply experiencing headache and back pain. In the older age group there was no difference among the pain types. Ruscheweyh and colleagues (2011) suggested that this may in part be due to different experiences with specific pain types. This view is fitting with biopsychosocial perspectives (e.g.,
Hadjistavropoulos et al., 2011); however, it does not explain why pain-related emotions are more strongly related to catastrophizing than pain intensity for one group and not the other. It could be that as age increases so does experience with pain, and perhaps individuals with more life experiences readily engage in behaviours or activities that have previously served to reduce negative emotional consequences of pain with success (Molton, Jensen, Ehde, Carter, Kraft, & Cardenas, 2008). Nonetheless, it is not clear how older adults compare to their younger counterparts with respect to catastrophizing. This may be due in part to methodological differences across studies (Leung, 2012; also see Gibson & Chambers, 2004 for an extensive review). Cook and colleagues (2006) noted that risk of injury, fear, and catastrophizing are generally viewed as being higher for older adults. However, their results demonstrated that older adult pain patients had lower pain-related fear relative to middle-aged patients who visited pain clinics. These findings are consistent with Ruscheweyh and colleagues (2011) who as noted earlier, demonstrated that in younger adults catastrophizing related to a pain eliciting situation is associated with emotional response to pain, while in older comparison adults it is only associated with pain intensity. Even so, others have argued that catastrophizing is independent of age (e.g., Keefe & Williams, 1990; Turner, Mancl, & Aaron, 2004), and ER (Diamond & Aspinwall, 2003) altogether. However, life-span perspectives of emotion (Carstensen, Isaacowitz, & Charles, 1999; Carstensen & Mikels, 2005; Labouvie-Vief, 2003; Labouvie-Vief, 2005) suggest that the ability to engage in ER increases with age because of more effective anticipation of negative emotions and an increase in social and cognitive resources. Investigation of the relationship between pain catastrophizing and pain-related emotions, as well as ER in older adults may provide insights with respect to
the methods by which pain and its associated constructs (i.e., intensity, catastrophizing, and pain-related fear) are managed during later stages of life.

Besides age differences, notable gender differences have also been found with respect to pain catastrophizing. For example, Sullivan and colleagues (1995) demonstrated that female undergraduate students score higher on measures of pain catastrophizing as compared to male counterparts when examining catastrophic ideation (Sullivan et al., 1995). Similarly, this trend held true when scores from the rumination and helplessness subscales of the Pain Catastrophizing Scale (PCS: Sullivan et al., 1995) were obtained after a CPT (Sullivan, Tripp, Rodgers et al., 2000; Sullivan, Tripp, & Santor, 2000). However, as previously eluded to, the directionality of this gender difference is not always consistent (Rivest, Cote, Dumas, Sterling, & De Serres, 2010) and in some investigations (e.g., Picavet, Vlaeyen & Schouten, 2002) no gender differences were found amongst those who engaged in pain catastrophizing. Nonetheless, the majority of findings tend to support the notion that women are more likely to catastrophize (e.g., Keefe et al., 2000) and an aim of this study was to examine the generalizability these findings.

**Other psychological factors influencing pain.** Consistent with biopsychosocial formulations, current understandings of pain indicate that psychological states including emotional reactivity can influence the level of pain endured by an individual. For example, anxiety has been demonstrated to increase pain in response to a noxious stimulus (Gatchel, 1999). The way a person reacts to pain relates to learned experiences. However, the relationship between psychological factors and the pain experience does not follow consistent trends (e.g., Asmundson & Katz, 2009; Linton & Shaw, 2011), and
warrants further investigation (Asmundson & Katz, 2009). In their review, Asmundson and Katz (2009) highlighted the increased co-occurrence of chronic pain and anxiety disorders; however, they also noted that few studies have adequately investigated the extent to which anxiety disorders precede the onset of pain, or vice versa. Understanding the nature of the temporal relationship between pain and anxiety is important because it could further clarify the possible mechanisms that link them together (see Asmundson & Katz, 2009 for a review). Consistent with Asmundson and Katz (2009), Rockett and colleagues (2013) found a high prevalence of psychopathology in medical and surgical inpatients suffering from pain. This was also found to be true of patients attending a pain management centre for treatment. The pain management group had higher median depression scores than both inpatient groups, and perhaps unexpectedly, the surgical group (despite the many uncertainties that are often associated with surgery) had a lower median anxiety score than the pain management group. These results potentially suggest that chronic pain sufferers may not have adequate ER strategies to manage their emotional distress and this may be coupled with a degree of hopelessness while short-term acute pain may be associated with greater hopefulness and better overall ER. Moreover, the existence of a relationship between chronic pain and mood disorders is well-established in outpatient settings, though this association is not always observed (Weisberg & Boatwright, 2007) providing evidence that these trends are not stable and can possibly be reversed through interventions directed at addressing both the physical and emotional disturbances associated with pain (e.g., ER skills training). Furthermore, the link between psychological factors and pain is clearer when comparing non-pain patient samples to their pain patient counterparts. For example, low back pain patients
reported significantly higher anxiety (9.5% versus 6.2%) and depression (13.7% versus 8.5%) than their non-low back pain counterparts. Low back pain patients also demonstrated more somatization (14.9% versus 8.3%) as compared to non-low back pain patients visiting community health centres (Bener et al., 2013). Other researchers have demonstrated that anxiety is a better predictor of long-term depression and pain severity than social stressors (Bair et al., 2013). These findings while not conclusive, suggest that targeting emotional distress in chronic pain sufferers may be valuable in improving their quality of life. To date, no investigation has specifically examined the association between suppression and reappraisal ER strategies and pain-related outcomes in older adults living with chronic pain. This study aimed to be the first to do so.

**Emotion Regulation**

Equally important to understanding the relationship between negative emotions and pain is how we regulate our negative emotions. People not only have emotions, but are able to regulate undesired ones as well (Frijda, 1986). Moreover, this regulation may occur before the onset of the negative emotion (anticipatorily), or even while it is still in progress. The chosen actions interact with the emotions by shaping them as well as becoming a part of them (Frijda, 1986). Furthermore, emotions are subject to regulatory action throughout all phases of the affective experience. Such regulation may take several forms such as the avoidance or pursuit of situations that increase emotional intensity (Frijda, 1986). Overt responses can be checked, attenuated, shaped, and/or replaced by some other response (Frijda, 1986, Thompson, 1994). Given this, ER by definition is the process of monitoring, evaluating, and altering emotional reactions (Gross, 1998a; Thompson, 1994). ER may be automatic or controlled, conscious or
unconscious, and may have its effects at one or more points in the emotion generative process (Gross & Thompson, 2007). While this definition is true, most measures such as the one used in this study focus on evaluating conscious and controlled aspects of ER because they are easier to assess and evaluate quantitatively (Gross & John, 2003).

**Process model of emotion regulation.** A widely accepted ER model is the process model which postulates that emotion can be regulated at five points in the emotion generative process. This may occur at 1) selection of the situation; 2) modification of the situation; 3) deployment of attention; 4) change of cognitions; and 5) modulation of experiential, behavioural, or physiological responses (Gross, 1998a/2001/2002; Gross & John, 2003). The first four processes are antecedent-focused, whereas the fifth is response-focused (Gross, 1998a/2001/2002; Gross & John, 2003). Antecedent-focused strategies refer to actions taken before the emotion response tendencies have become fully activated and have changed our behaviour and peripheral physiological responding, whereas response-focused strategies refer to actions occurring once an emotion is underway; after the response tendencies have already been generated (Gross, 2001; Gross & John, 2003). Although there are a number of ER strategies such as rumination, problem-solving, and acceptance (see Aldao, Nolen-Hoeksema & Schweizer, 2010 for a review), only two, cognitive reappraisal and expressive suppression have been well-defined in the literature (Gross 2001; Gross & John, 2003). These two strategies are most commonly used by people on a daily basis, and are easiest to manipulate experimentally (Gross & John, 2003). The aim of this study is to explore and compare these two ER dimensions in older adults living with chronic pain to their
younger chronic pain counterparts in order to examine whether age and gender influence choice of ER strategy.

**Cognitive reappraisal and emotional suppression.** To date, investigations have had limited focus on whether specific ER capacities act independent of facets of chronic pain coping and catastrophizing in younger adults (e.g., Agar-Wilson & Jackson, 2012). A goal of this present study is to extend such research to older adult populations living with chronic pain. Cognitive reappraisal or more commonly referred to as reappraisal is an antecedent-focused (Gross & John, 2003) form of cognitive change that involves construing a potentially emotion-eliciting situation in a way that changes its emotional impact (Lazarus & Alfert, 1964). Put simply, reappraisal involves changing the way one thinks about an emotional event. Expressive suppression of emotions (also referred to as suppression) is a response-focused (Gross & John, 2003) form of response modulation that involves inhibiting ongoing emotion-expressive behaviour (Gross, 1998b).

Suppression can refer to the inhibition of thoughts and/or emotions. Thought suppression involves consciously attempting to stop or avoid having a specific cognition (see Wegner, Schneider, Carter, & White, 1987 for a discussion), while emotion suppression can be likened to holding a poker face while having a great hand (Gross & John, 2003). Only the latter form of suppression (i.e., emotion suppression) was investigated in this study. Reappraisal differs from suppression in that it occurs early, and intervenes before the emotion response tendencies have been fully generated. Reappraisal can thus efficiently alter the entire subsequent emotion trajectory (Gross & John, 2003). As such, when used to down-regulate negative emotion, reappraisal should successfully reduce the experiential and behavioural components of negative emotions.
Suppression on the other hand, comes relatively late in the emotion-generative process and primarily modifies the behaviours associated with emotion response tendencies. Suppression should be effective in limiting the behavioural expression of negative emotions, but might have unintended consequences such as inhibiting the expression of positive emotions as well (Gross & John, 2003). In addition, suppression will not aid in reducing the experience of negative emotions, since such experiences are not directly targeted by this strategy. As such, suppression may allow negative emotional experiences to linger and remain unresolved (Gross & John, 2003). Finally, because suppression comes late in the emotion-generative process, it involves the individual effortfully managing the emotional response tendencies as they continually arise, which can further consume cognitive resources that can be directed elsewhere (Gross & John, 2003). Gross (1998b) demonstrated that participants who were asked to suppress emotional reactions to a negative emotion-eliciting film were able to display reduced expressive behaviour, yet they experienced equal negative emotion in comparison to participants who were asked to just watch the film. Participants assigned to the reappraisal condition (i.e., they were asked to think about the film they were watching so that they would not respond emotionally) demonstrated decreases in both the experience and the behavioural expression of negative emotions (Gross, 1998b). Researchers have consistently found results suggesting attempts to suppress negative emotions does not impact the experience of negative emotions, whereas suppressing positive emotions decreases the experience of positive emotions (e.g., Gross & Levenson, 1997; Stepper & Strack, 1993). This is a clear indication that suppression is likely to be
ineffective in managing emotional distress in chronic pain populations since this type of pain is rarely associated with pleasure.

Gross and John (2003) also demonstrated that reappraisal was related to greater experience and expression of positive emotion. In addition, reappraisal relates to less intense negative emotional experience and reduced negative emotion expression. On the other hand, suppression predicted a negative link to emotional experience. That is, individuals who relied on suppression experienced and expressed fewer positive emotions. Interestingly, Gross and John (2003) noted that individuals using suppression were more likely to experience negative emotions than nonsuppressors consistent with their idea that suppression resulted in greater negative affect. They suggested that the likelihood of engaging in suppression provided an individual with the opportunity to become aware of their own inauthenticity (Gross & John, 2003); further suggesting that ER dimensions may play an influential role in determining affect and adjustment outcomes for people with chronic pain.

Measurement of emotion regulation. The present study aimed to validate the ERQ (Gross & John, 2003) in a general population of older adults. Further evidence of validity was obtained through the examination of theoretical relationships between ER as measured by Gross and John’s (2003) ERQ, pain, and other pain-related factors across both younger and older adult chronic pain populations. Given this specific goal, it is important to note that measurement of ER has predominantly taken three forms. First, it is suggested that changes (e.g., anger to sadness) or fluctuations in emotional intensity are valid indicators of ER taking place (e.g., Agar-Wilson & Jackson, 2012; Connelly et al., 2007; Paquet et al., 2005). Investigations of this nature relied predominantly on self-
reported changes in emotions using visual analogue scales (e.g., Quartana & Burns, 2007) or operationalized ER as the maintenance of recovery of self-supporting, desirable emotional states over specific episodes (e.g., Paquet et al., 2005). This operationalization of ER poses a major challenge. Specifically, when considering biopsychosocial formulations of pain (e.g., Hadjistavropoulos et al., 2011) and consistent with investigations of emotions and acute pain (e.g., Hale & Hadjistavropoulos, 1997), the relationship between the experience of pain, environment, and emotions is subjective in nature and each factor can influence the other in both positive and negative ways, which may not be captured by simple verbal self-report of mood and/or emotional changes.

A second common method of indirectly investigating ER is through the use of self-report measures designed to assess emotions and various emotion-related concepts (e.g., Burns, Quartana, & Bruehl, 2007). For example, researchers may use tools designed to assess specific emotional traits and expressions (e.g., Burns et al., 2007) or instead rely on broad measures of positive and negative affect such as the Positive and Negative Affect Scale (PANAS: Watson, Clark, & Tellegen, 1998). Measures used as part of this strategy are not developed to specifically assess ER across a variety of settings, situations, and psychosocial factors, or are limited in terms of their validity in assessing ER. Thus, it is unclear how well such measures actually capture variance in ER within specific populations such as the demographics recruited in this study.

The third, and perhaps most recent way of assessing ER is through the use of specialized tools designed to evaluate ER and related constructs (e.g., suppression, reappraisal). Measures developed for this purpose include the ERQ (Gross & John, 2003), Emotional Acceptance Questionnaire (EAQ: Beblo et al., 2011), Difficulties in
Emotional Regulation Scale (DERS: Gratz & Roemer, 2004), Emotion Regulation Profile-Questionnaire (ERP-Q: Quoidbach, Nelis, Mikolajczak, & Hansenne, 2007), and the Emotion Regulation Profile-Revised (ERP-R: Nelis, Quoidbach, Hansenne, & Mikolajczak, 2011). Of these, only the ERQ and DERS are available in English, and for the purpose of this study, only these two measures will be discussed further. Both the DERS and ERQ have been shown to have good initial validity and reliability (Gratz & Roemer, 2004; Gross & John, 2003). Moreover, both measures have been used in a wide variety of investigations. For example, the DERS has proven useful in studies investigating ER and posttraumatic stress disorder (Tull, Barrett, McMillan, & Roemer, 2007) as well as investigations of other anxiety disorders (e.g., Mennin, McLaughlin, & Flanagan, 2009), while the ERQ has been shown to be effective in measuring specific ER strategies in depression (Aldinger et al., 2013; Ehring, Tuschen-Caffier, Schnülle, Fischer, & Gross, 2010) and pain (Burns et al., 2010; Burns, Quartana, Bruehl, 2011; Uysal & Lu, 2011; van Middendorp et al., 2008). While the DERS (Gratz & Roemer, 2004) is designed to assess for ER dysregulation or dysfunction, it provides limited information about strategies relied upon to manage emotions since this is not a focus of the measure items. On the other hand, the ERQ (Gross & John, 2003) has a narrow focus in which only two ER strategies, suppression and reappraisal are assessed. Even so, it has been shown to be useful in the assessment of pain populations as both suppression and reappraisal are common and easily quantifiable strategies (Gross & John, 2003).

In examining the psychometric prosperities of the original 10-item ERQ (Gross & John, 2003), Spaapen and colleagues (2014) determined that the measure was not a valid fit with two large English-speaking populations ranging in age from 17-95 years of age.
A proposed 9-item ERQ provided stronger psychometric properties as determined through confirmatory factor analysis. The revised 9-item ERQ was found to be more equivalent with regards to age, gender and education across the combined population samples when examined through measurement invariance testing (Spaapen, Water, Brummer, Stopa, & Bucks; 2014). To date, only one recent investigation (de Frias, 2014), albeit with a healthy community dwelling sample, has attempted to use the ERQ exclusively with older adults. In this investigation, de Frias (2014) recruited participants as young as 50 years old when age 65 or older might have been a more appropriate cut off age to study an older adult population (Abeles et al., 1998). The lower age limit may have been done in order to mitigate the many challenges with recruitment amongst this population (Bonk, 2010). Examples of these challenges include physical impairments, chronic illnesses, and transportation challenges (Bonk, 2010). Moreover, mental and physical health-related diagnoses were considered as exclusionary criteria by de Frias (2014), despite the high prevalence of such concerns amongst community dwelling older adults (e.g., Lo Coco, Lopez, & Corrao, 2016). Thus, a limitation of de Frias’ (2014) investigation is that the ERQ has not been validated for use with older adults 65 years of age or older. This study aimed to validate the ERQ in a general population of older adults. In the de Frias (2014) investigation “acceptable” internal consistency for the reappraisal (0.83) and suppression (0.74) subscales were found. Moreover, intercorrelation between the subscales was found to be nonsignificant. This study aimed at addressing the consistent limitations found in ER investigations (e.g., not targeting specific ER skills and only assessing variations in emotions; Agar-Wilson & Jackson, 2012; Connelly et al., 2007; Paquet et al., 2005). This study addresses the non-specific
definition typically used in ER studies by using a specific measure (ERQ) that assesses defined strategies associated with ER (i.e., suppression and reappraisal).

**Psychosocial outcomes of emotion regulation.** Over the last several decades, peer-reviewed publications focusing on ER increased nearly 3000 times (Gross, 2007). As a result, the study of ER continues to expand at a rapid pace despite lacking conceptual and theoretical clarity which has contributed to a wide range and often contradictory set of findings (Ford & Gross, 2018). Most research in this area investigated outcomes with non-pain conditions such as smoking cessation and cannabis use (e.g., Boden, Gross, Babson, & Bonn-Miller, 2013; Fucito, Juliano, & Toll, 2010), anxiety and mood disorders (e.g., Tortella-Feliu, Balle, Sesé, 2010), schizophrenia (e.g., van der Meer, van’t Wout, & Aleman, 2009), and eating disorders (e.g., Brockmeyer, Bents, Holtforth, Pfeiffer, Herzog, & Friederich, 2012; Svaldi, Griepenstroh, Tuschen-Caffier, & Ehring, 2012). Since this study investigated psychosocial influences on ER, it is worth noting that with respect to anxiety and mood disorders a general trend seems to indicate that emotional suppression is associated with increased physiological symptoms of anxiety and decreases in overall mood (e.g., Campbell-Sills et al., 2006a; Campbell-Sills, Barlow, Brown, & Hofmann, 2006b; Spaapen et al., 2014). This is consistent with a meta-analysis that demonstrated that use of maladaptive ER strategies (e.g., suppression) was correlated with greater symptoms of depression, and anxiety, while adaptive ER strategies (e.g., reappraisal) were negatively related to psychopathology (Aldao et al., 2010).

**Emotion regulation and gender difference.** General trends aside, a focus of this study was on whether gender differences will be observed in ER strategies, particularly in
chronic pain populations. According to Barrett and Bliss-Moreau (2009) women are recognized as being more likely to experience intense emotions while men are viewed as more likely to suppress or avoid such emotions. Thus, it is not surprising that support exists for gender differences with regards to ER. Nolen-Hoeksema and Aldao (2011) determined that women were more likely than men to report using most ER strategies. Specifically, women reported using rumination, seeking social support, reappraisal, problem-solving, and acceptance significantly more than their male counterparts. In contrast, males have consistently been shown to engage in more maladaptive suppression strategy use as compared to their female counterparts (Balzarotti et al., 2010; Gross & John, 2003; Melka, Lancaster, Bryant, & Rodriguez, 2011; Spaapen et al., 2014; Wiltink et al., 2011); while no differences have been found in reappraisal strategy use (e.g., Gross & John, 2003). These findings are supported by Tamres and colleagues (2002) who performed a meta-analytic review and found that women ruminated significantly more than men, as well as they were more likely to engage in reappraisal or problem-focused coping. Furthermore, Tamres and colleagues (2002) concluded that women engaged in more non-traditional ER strategies that were in line with gender role theories. These included employing wishful thinking, seeking social support, and turning to religion for comfort. Of course, this also fits with Barrett and Bliss-Moreau (2009) who argued that women are generally more likely to express emotions than men. In sum, it is expected that this study will also confirm gender differences with respect to the implementation of two main ER strategies (i.e., suppression and reappraisal) in both older and younger adults living with chronic pain.
**Emotion regulation and aging.** Besides gender differences, another area of specific focus for this study is whether age influences the choice of a specific ER strategy, particularly in older adult chronic pain populations. Consistent with the socioemotional selectivity theory (Charles & Carstensen, 2007) it is generally believed that reappraisal use will increase with age, since older individuals are more readily aware of the value in discovering positive meaning in face of adversity and challenge. Moreover, suppression use is generally expected to decrease with age since it involves remaining emotionally inconsistent with the experience at hand. However, Nolen-Hoeksema and Aldao, (2011) determined that the use of most ER strategies except suppression and acceptance decreased with age. Contrary to Nolen-Hoeksema and Aldao (2011), John and Gross (2004) showed that older women reported lower use of expressive suppression compared to younger women. Moreover, older women also engaged in greater use of cognitive reappraisal than their younger counterparts. However, these findings must be interpreted with caution as other investigations have demonstrated no age-related differences in suppression or reappraisal strategy use (Spaapen et al., 2014) thus suggesting that ER behaviour remains consistent throughout the life-span (Kunzman, Kupperbusch, & Levenson, 2005).

One other important investigation of ER comparing younger to older adults determined that the two groups of participants did not differ in terms of acceptance and awareness of emotional responses (Orgeta, 2009). Even so, younger adults as compared to their older adult counterparts, provided responses that suggested greater difficulties understanding their emotions and increased challenges with affect regulation. Older adults reported greater control over impulsive emotional responses, and increasing age
was associated with greater access to non-specific ER strategies (Orgeta, 2009). Orgeta’s (2009) findings are consistent with the belief that as age increases, individuals begin a normative shift towards the use of more adaptive regulation strategies (John & Gross, 2004). In conclusion, there appears to be evidence that suggests age does influence ER. While this evidence is not entirely conclusive, a goal of this present study was to add further insight to the discussion.

**Emotion regulation and pain.** The relationship between pain and emotions is well documented (e.g., Hale & Hadjistavropoulos, 1997). As such, it is essential to consider the importance of ER in managing the emotional distress commonly associated with pain (e.g., Hadjistavropoulos et al., 2011). General findings from investigations of ER and pain support the differing roles of reappraisal and suppression in regard to emotional outcomes associated with pain (e.g., Cioffi & Holloway, 1993; Quartana & Burns, 2007). Specifically, reappraisal has consistently been demonstrated to be more advantageous than suppression strategies when it comes to regulating distressing emotions commonly associated with pain (e.g., Gilliam, Burns, Quartana, Matsuura, Nappi, & Wolff, 2010). While it is generally understood that suppression as a strategy is detrimental to the overall pain experience (e.g., Cioffi & Holloway, 1993; Sullivan, Rouse, Bishop, & Johnston, 1997) it is believed that the frequency of unwanted thoughts that occurs during suppression is the actual mediating factor between pain and suppression (Sullivan et al., 1997).

There are a number of limitations to the existing body of research examining ER and pain. Most notable among these limitations are the use of non-ER specific measures and a reliance on healthy undergraduate student samples (e.g., Burns et al., 2010).
Studies involving ER and pain can broadly be categorized as involving experimentally induced pain and/or affect (e.g., Cioffi & Holloway, 1993; Quartana & Burns, 2007) or non-experimentally induced pain and/or affect (Connelly et al., 2007).

One method of examining ER and pain is to experimentally induce pain through the use of the CPT, or other safe pain-induction methods (e.g., Burns et al., 2010; Hampton et al., 2015). This is the method used in the important early work in ER and pain done by Cioffi and Holloway (1993), who encouraged participants to engage in three different forms of ER. As part of this study, participants were assigned to one of three conditions: 1) distraction from the CPT by focussing on a familiar home environment; 2) monitoring by paying close attention to sensations in their hand while completing the CPT; and 3) suppression by removing awareness of sensations from their mind. After two minutes post-CPT, participant pain ratings demonstrated that monitoring produced the most rapid recovery from pain, while suppression produced the slowest (Cioffi & Holloway, 1993). These findings were also replicated by Elfant, Burns, and Zeichner (2008). Hampton and colleagues (2015) examined the impact of suppression and reappraisal (as measured by the ERQ) on verbal and non-verbal pain expression following experimental manipulation of pain within a university laboratory setting. When comparing results against a control group, reappraisal was found to be more effective in reducing pain intensity, pain unpleasantness, anxiety, and tension in addition to reduced facial expressions. Suppression in contrast, was found to lower self-reported pain intensity and facial expressions when compared to a control condition. Hampton and colleagues (2015) concluded that both strategies were effective in managing
experimentally induced pain and further reported that neither strategy was influential with regards to pain threshold and tolerance levels.

Burns (2006) investigated healthy persons and chronic low back patients who completed a CPT while being placed into a distraction, sensory focus, suppression, or control study condition. In addition to completion of the CPT all participants were asked to complete mental arithmetic as a stressor. Suppression strategy in this case was deemed to perpetuate negative thoughts and emotions induced by pain. The nonsuppression strategies had ameliorative effects on stress responses as a result of the CPT (Burns, 2006). Although much of the research on ER and pain has been limited to highlighting the detrimental effects of suppression as compared to other ER strategies, very few investigations have explored dimensions that could counteract the effects of suppression directly. One such study by Ruiz-Aranda and colleagues (2010) determined that women who scored high on the emotional repair subscale of the Trait Meta-Mood Scale (TMMS: Salvoy, Mayer, Goldman, Turvey, & Palfai, 1995) as compared to those who scored low, reported reduced sensory and affective pain qualities during a CPT. Moreover, these women reported a more positive affective state before beginning the CPT as well as better overall mood during the CPT, thus demonstrating lower negative impact of pain (Ruiz-Aranda, Salguero, & Fernández-Berrocal, 2010).

**Emotion regulation and chronic pain.** Few investigations to date have examined the impact of ER on chronic pain (Koechlin et al., in press). Investigations of ER and chronic pain largely rely on samples of convenience involving female adult populations (see Koechlin et al., in press for a recent review). The present study is the first to examine the role of ER with regards to both younger and older adult chronic pain...
populations split evenly across both genders. Moreover, this area of research is plagued by variable operationalizations of ER (e.g., defined as a coping style, emotional awareness, or emotional intelligence) thus making it difficult to establish trends (Koechlin et al., in press). Even so, limited evidence exists to support the relationship between ER and chronic pain outcomes. For example, some researchers point to a lack of direct evidence suggesting ER influences chronic pain outcomes (e.g., Agar-Wilson & Jackson, 2012; Hamilton, Zautra, & Reich, 2005) while others have specifically found that neither ER reappraisal nor suppression are believed to be correlated with chronic pain outcomes (e.g., van Middendorp et al., 2008; Wong & Fielding, 2013). More specifically, an investigation of sleep and fibromyalgia involving 35 adult females found that ER as measured by the Emotion Amplification and Reduction Scales (TEARS: Hamilton, Karoly, Gallagher, Stevens, Karlson, & McCurdy, 2009) was unrelated to both sensory and affective dimensions of chronic pain (Hamilton et al., 2012). In contrast a recent investigation of 256 chronic low back patients showed that difficulties with ER contributed to negative affectivity, pain intensity, and disability (Le Borgne, Boudoukha, Petit, & Roquelaure, 2017). This study aimed to add further evidence clarifying the role of ER with regards to both sensory and affective dimensions of chronic pain.

Geenen and colleagues (2012) investigated the impact ER (emotion expression and cognitive reappraisal) and emotion processing style had on fibromyalgia in 403 middle-aged adult women. Emotion processing style was defined as affect intensity (i.e., strength with which emotions are experienced) and alexithymia or the difficulty identifying and describing emotions (Geenen, van Ooijen-van der Linden, Lumley, Bijlsma, & van Middendorp, 2012). Geenen and colleagues (2012) hypothesized that the
combination of a high affect intensity processing style with an emotion expression strategy would be associated with better adjustment or lower impact on fibromyalgia (e.g., physical impairment, pain levels, fatigue, stiffness, days of work missed, and general coping) than the combination of high affect intensity with cognitive reappraisal. In addition, it was thought that alexithymia along with reappraisal would yield better adjustment than alexithymia and emotion expression. Findings revealed that among high affect intensity women, emotion expression and not cognitive reappraisal was associated with less fibromyalgia impact. Reappraisal was not found to be more adaptive as compared to emotion expression for women with alexithymia (Geenen et al., 2012). The researchers concluded that women experiencing chronic pain and intense emotions may benefit from disclosure of emotions or strategies aimed at expressing them in contrast to cognitive reappraisal strategies. The Greenen et al. study was not without limitations, namely relying on a large female only sample limits the generalizability of the findings to the general population. Moreover, Geenen and colleagues (2012) limited their investigation to the evaluation of adaptive ER strategies (e.g., expression and reappraisal) while ignoring maladaptive strategies (i.e., suppression) despite utilizing Gross and John’s (2003) ERQ. The present study was designed to address these limitations by comparing adaptive and maladaptive strategies in a sample of older and younger adult chronic pain population divided evenly across both genders.

Agar-Wilson and Jackson (2012) attempted to determine whether ER capacities were related to functioning independent of pain coping. Results demonstrated that efficacy in non-specific ER was related to quality of life as well as reduced negative affect independent of adjustment, pain coping efficacy, and overall pain coping.
Contrary to previous ER and pain investigations (e.g., Burns, 2006; Ruiz-Aranda et al., 2010), features of ER were not significant predictors of pain-related disability independent of measures of adjustment, pain coping efficacy, and pain coping in general (Agar-Wilson & Jackson, 2012). Agar-Wilson and Jackson (2012) concluded that individual differences in adjustment might be better understood by considering skills related to ER, and proposed investigating how ER skills contribute to specific types of emotional distress such as fear.

**Emotion regulation, pain, and gender differences.** Burns and colleagues (2010) attempted to expand on previous CPT studies by examining gender differences. Undergraduate students were randomly assigned to a suppression or nonsuppression condition. Each participant was asked to participate in a CPT and to engage in the strategy to which he or she was randomly assigned. Burns and colleagues (2010) concluded that men in the nonsuppression condition reported lower pain and unpleasantness than women in the same condition. Men in the suppression condition also reported greater pain and unpleasantness than their male counterparts in the nonsuppression condition, but equivalent pain and unpleasantness to women in the nonsuppression condition. Their results indicate that within the nonsuppression condition women’s increased perceived pain levels in contrast to men were partly mediated by their report of greater spontaneous use of avoidance/suppression during the CPT (Burns et al., 2010). Burns and colleagues (2010) noted that their findings may have more to do with laboratory induction of pain and these gender differences may or may not hold in chronic pain populations. Moreover, since the women did not report significant increment in pain intensity in response to the laboratory manipulation like the men did, does temper
whether suppression can be credited with differences found between both genders (Burns et al., 2010). This issue was addressed in the current study by obtaining samples of older and younger adult participants matching across both genders who are currently living with chronic pain.

*Emotion regulation, pain, and older adults.* Only one investigation of ER involved a sample of older adults, 65-years or older with pain (Paquet et al., 2005). Participants in this study did not have dementia, depression, or chronic pain as diagnoses (Paquet et al., 2005). Acute pain intensity data were collected for a total of 909 sampling episodes during the morning and afternoon. Paquet and colleagues (2005) found no differences between morning and afternoon scores for pain intensity, emotion intensity, and regulation strategy. Nonetheless, a limitation of this investigation was the way ER was defined. Specifically, ER was operationalized as the maintenance or recovery of self-supporting, desirable emotional states over specific episodes. As such, ER was measured as change in emotional intensity (i.e., more intense positive or less intense negative emotions) between sampling episodes during hospital stay. Furthermore, younger older adults (65-79 years of age) were more likely to perform regulation of both anger and positive feelings compared to their older counterparts (80+ years of age). Interestingly, older adults living with someone were more successful at regulating feelings of depression than those who were residing alone (Paquet et al., 2005). In addition, women were more likely to maintain their anxiety at lower levels than their male counterparts, whereas participants with higher degrees of depression at baseline were less likely to maintain lower levels of depression. The relationship between pain and ER was primarily driven by a participant’s ability to regulate anxiety, and better
anxiety regulation was linked to lower overall pain intensity; however, the relationships between pain intensity and the regulation of anger, depression, and positive feelings were not found to be significant (Paquet et al., 2005). Paquet and colleagues (2005) drew several inferences from this investigation. First, effective regulations of emotions by older adults with pain in the course of daily activities while in hospital are primarily determined by anxiety regulation. Furthermore, one’s ability to regulate emotions seems to vary by age and gender (Paquet et al., 2005). This area of research is becoming increasingly important because to date few investigations have explored the role of ER with respect to the experience of chronic pain in older adults.

**Emotion regulation and pain catastrophizing.** ER has also been considered in the context of pain catastrophizing. Specifically, Sullivan and colleagues (1997) randomized undergraduate students in suppression and nonsuppression conditions and asked them to complete a CPT and report pain levels. Suppression condition participants reported higher pain intensity than their nonsuppression counterparts. Moreover, within the suppression condition, those who reported more catastrophizing experienced significantly more intrusive unwanted thoughts than people who did not catastrophize in the same condition. When the intrusive thoughts were controlled for, condition differences were no longer significant between suppression and nonsuppression participants (Sullivan et al., 1997). As such, suppression and catastrophizing were associated with a heightened pain experience, and the frequency of thought intrusions (i.e., personally relevant and negative unwanted thoughts [e.g., Salkovskis & Campbell, 1994]) mediated the relationship between the suppression condition and pain, but not between catastrophizing and pain. These conclusions were supported by Gilliam and
colleagues (2010) who determined that high scorers on scales assessing rumination and helplessness, as well as the likelihood to suppress unwanted thoughts and feelings reported the greatest pain and distress during the recovery phase after completing an ischemic pain task. Thus, people who catastrophize and attempt to use maladaptive ER strategies such as suppression may be particularly susceptible to prolonged recovery phases and more likely to feel prolonged discomfort (Gilliam et al., 2010).

Wong and Fielding (2013) investigated the relationship between reappraisal and suppression with respect to negative affect and pain catastrophizing in a large sample of Chinese chronic pain patients who completed self-report questionnaires measuring pain intensity, ER, negative affect, and pain catastrophizing. Wong and Fielding (2013) found that both expressive suppression and cognitive reappraisal were significantly associated with pain catastrophizing; however, the significant association between cognitive reappraisal and pain catastrophizing did not hold after controlling for demographic and pain variables. Moreover, expressive suppression was found to mediate the relationship between negative affect and pain catastrophizing. This suggests that the choice of ER strategy in response to negative emotions can affect subsequent appraisals of the pain experience, specifically, high or low pain catastrophizing (Wong & Fielding, 2013). Interestingly, only suppression accounted for the relationship between pain catastrophizing and negative affect. Suppression did not qualify as a moderator between negative affect and pain catastrophizing (however it did partially mediate the effects of negative affect on catastrophizing). No evidence was found to suggest that cognitive reappraisal is a mediator or moderator in the relationship between negative affect and pain catastrophizing. Wong and Fielding’s (2013) investigation is not without
limitations. The researchers did not determine if participants who declined to participate differed in any way from those who chose to participate, and it is probable that most of their participants suffered from other pain conditions beyond musculoskeletal type which they did not control for. In addition, participants were recruited from a convenience sample found within public service orthopaedic clinics where failure to show improvements after one or two years resulted in referral elsewhere, further limiting generalizability of the findings (Wong & Fielding, 2013). In the present study, older adults living with pain for longer than three months were recruited, thus broadening the generalizability of our findings within chronic pain and older adult populations.

Emotion regulation, pain, and induced emotions. Given the degree of interrelation between pain and emotions, one method of examining ER in pain is through the indirect experimental induction of (negative) emotions rather than directly inducing pain experimentally. This method is useful as it permits the exploration of relationships among numerous emotions often associated with pain across different settings and conditions. For instance, in a sample of chronic low back pain patients who attempted to suppress anger, researchers found that suppression of angry emotions may actually aggravate pain related to patients’ clinical condition and led to more pain specific and coping behaviours (Burns et al., 2011; Burns et al., 2008). Other researchers have found that asking individuals to engage in suppression and acceptance-based strategies while anticipating and receiving electric shocks in a laboratory is more effective than not engaging in these strategies (Braams, Blechert, Boden, & Gross, 2012). Both acceptance and suppression strategies led to reductions in pain reports. However, although better
than no strategy, suppression was significantly less effective at reducing anticipatory anxiety and pain than acceptance strategies (Braams et al., 2012).

**Limitations of emotion regulation and pain research.** Given the paucity of ER and pain investigations, concern lies with the way ER has been conceptualized. For example, Connelly and colleagues (2007) investigated whether ER impacted pain and other symptoms of predominantly female rheumatoid arthritis adult patients (72% female) using a daily diary method. The method by which ER was operationalized (i.e., self-reported negative or positive affect intensity fluctuation between any two consecutive days) is limiting at best, since it does not allow for specification of the mechanism by which emotional change took place.

Like Connelly and colleagues (2007), other investigations not involving experimental induction of pain have used predominantly female participants, which may limit the generalizability of the findings. For example, van Middendorp and colleagues (2008) concluded that patient (e.g., fibromyalgia) populations and healthy participants do not significantly differ in the use of ER reappraisal strategies; however, they did significantly differ in emotional suppression, with patient populations reporting increased use as compared to healthy controls. Specifically, suppression (and not reappraisal) was significantly related to emotional distress; even though neither suppression nor reappraisal was related to pain (van Middendorp et al., 2008). Caution should be undertaken when exploring the generalizability of these findings as van Middendorp and colleagues (2008) investigated ER in women only. Moreover, the control group in this investigation was not derived from a random sampling of the population and hence it is possible that they did not accurately represent the general public, further limiting the
findings (van Middendorp et al., 2008). The researchers suggested that future investigations actively recruit comparison groups from a general pain population, as was done in this current study.

Other areas in which this study aims to improve upon the current literature is related to the limited way ER within older adult populations has been investigated to date. For example, de Frias (2014) defined older adults as aged 50 years or older while Paquet and colleagues (2005) had a participation rate of 39%, which suggested that their study sample was not representative of the overall population. The researchers’ described that their participants may have had lower pain intensity and better health than those who withdrew their participation or declined to participate in the first place (Paquet et al., 2005). Paquet and colleagues (2005) did not assess for specific ER strategies and rather chose to rely on self-reported fluctuations in emotion over time as an indicator of ER taking place (Paquet et al., 2005). Assessing specific ER strategies using a validated measure using an older adult population (i.e., aged 65 years or older) allowed this study to address such limitations

**Study 1: Purpose**

Given that the psychometric properties of the ERQ (Gross & John, 2003) have not been systematically investigated with an older adult population, the purpose of the first study is to evaluate the measure within this population.

**Study 1: Expectations**

It was expected that the ERQ (Gross & John, 2003) would yield adequate internal consistency (e.g., $\alpha > 0.70$) in a sample of older adults. Consistent with Cohen (1988) it was expected that the ERQ would show adequate discriminant validity (i.e., $r < 0.30$)
with measures assessing non-regulation specific emotion-based constructs such as the Penn State Worry Questionnaire-Abbreviated (PSWQ-A: Hopko et al., 2003) and the Center for Epidemiologic Studies – Depression Scale (CES-D: Radloff, 1977). With respect to convergent validity, it was expected that the ERQ subscales would significantly correlate in the moderate to strong range with a measure that is theoretically identical in design and development to itself. Specifically, the reappraisal subscale of the ERQ would correlate significantly (i.e., $r \geq 0.30$) with the adjusting subscale of the Affective Style Questionnaire (ASQ: Hofmann & Kashdan, 2010) while the concealing subscale of the ASQ would correlate strongly with the suppression subscale of the ERQ. The replication of these results would extend Hofmann and Kashdan’s (2010) findings with undergraduate populations to older adult populations as well, while providing additional evidence for the convergent validity of Gross and John’s (2003) original ERQ.

**Study 1: Methods**

**Participants**

Data was collected from 83 community dwelling older adults ranging in age from 65-92 years. Concurrent or history of mental and physical health-related diagnosis (i.e., dementia, Parkinson’s disease, stroke, brain injury, schizophrenia) were not considered as exclusionary criteria, unlike previous research by de Frias (2014), given the relatively high prevalence of such concerns amongst community dwelling older adults (e.g., Lo Coco et al., 2016).

Both Study 1 and Study 2 were reviewed and approved by the University of Regina Research Ethics Board (Appendix A). Prior to participating in the study, all participants reviewed and completed a consent form (see Appendix B for Study 1 online...
and paper-based forms and Appendix C for Study 2 online form). Personal information and all participant responses remained confidential. Once responses were entered into the database, identifying information was kept separate from the data to prevent any identification of participants.

**Procedure**

A dual recruiting strategy for increasing older adult participation was employed in the present study in order to overcome challenges often associated with older adult research participation (Bonk, 2010). This approach was similar to that taken by Spaapen and colleagues (2014) in order to increase participation rates as well as overcome possible geographical limitations with regards to the representativeness of the older adult population sample. Locally-based paper and pencil recruitment was supplemented with a national online recruitment approach. Potential local participants were identified through a University of Regina Centre on Aging and Health database of registered older adult volunteers. These individuals were either contacted through telephone and/or met with in person in order to discuss potential participation. Other local participants were recruited through brief presentations at assisted living and retirement facilities as well as at a presentation table set up at a local conference. Local participants were invited to complete questionnaires which were then returned through the postal mail using pre-paid postage envelopes. A larger group of older adults were recruited nationally through social media (i.e., Facebook) advertising campaigns. Social media provides a rapid and cost-effective data collection strategy for difficult to reach and specific demographic groups of interests (King, O’Rourke, & DeLongis, 2014). Furthermore, in order to enhance the online respondent’s experience, recommendations by King and colleagues
(2014) were followed. Specifically, a dedicated survey website was set up through Survey Monkey (www.surveymonkey.ca). Having a dedicated survey website and limiting the overall time to complete the survey was expected to assist in minimizing participant burden (e.g., King et al., 2014). As part of this strategy, the website employed for this study displayed a progress bar with the goal of encouraging participants to consider the amount of questions they have remaining in order to reduce the chances for early discontinuation of the study. In addition, each unique internet protocol address (IP address) was limited to a single response opportunity in order to reduce duplicate responding from the same electronic device. Attention factor items were embedded between uploaded measures in order to reduce or potentially assist in identifying inaccurate responding (King et al., 2014). For example, respondents were required to select the number seven before moving on to the next question. All participants were provided with researcher contact information (i.e., telephone and e-mail) to ensure opportunities for communication at all stages of recruitment and data collection. By participating in the study, participants could enter their name for a chance to win a $100 CAD cash prize. A single cash prize was offered to both online (national) as well as local study participants as an incentive for participation in keeping with study design recommendations (e.g., King et al., 2014). Furthermore, it was expected that consistent with previous research, the online and traditionally recruited participants would not differ in response styles with respect to survey items (e.g., Gosling, Vazire, Srivastava, & John, 2004). Participants completed a demographic questionnaire, the PSWQ-A, CES-D, ASQ, and the ERQ in hardcopy format or through Survey Monkey.
Measures

**Demographic Questionnaire.** Participants were asked to complete a brief demographic questionnaire (see Appendix D). Specifically, they provided information about their age, relationship status, gender, and length of time living with pain. Pain medication management was also queried. The questionnaire responses can only be identified through the unique participant number assigned to each participant.

**Affective Style Questionnaire.** The Affective Style Questionnaire (ASQ: Hofmann & Kashdan, 2010) assesses three general strategies commonly used to manage emotional reactions. The 7-item adjustment subscale (e.g., “I can get into a better mood quite easily”) is aimed at measuring re-adjustment of affect to adapt successfully to situational demands. The 8-item concealment subscale (e.g., “people usually can’t tell when I am sad”) measures degree of concealment or suppression of affect. The 5-item tolerance subscale (e.g., “I can’t tolerate having strong emotions”) is intended to assess tolerance and acceptance of emotions including unwanted and aversive reactions (Hofmann & Kashdan, 2010). Items on these subscales are rated on a 5-point Likert-type scale (ranging from 1 = not true of me at all to 5 = extremely true of me). Hofmann and Kashdan (2010) based the final 20-item ASQ on items derived from original research completed by the ERQ developers (e.g., Gross & John, 2003; Gross & John, 1997). In undergraduate samples, the ASQ has demonstrated satisfactory internal consistency with regards to the concealing ($\alpha = 0.84$), adjusting ($\alpha = 0.80$), and tolerating ($\alpha = 0.66$) subscales. The item-total correlations were all $rs \geq 0.57$ for the three subscales ($ps < 0.001$). While exploration of psychometric properties of the ASQ has been limited to replication with undergraduate populations; the theoretical emphasis of designing the
ASQ largely based on the work completed by Gross and John (2003) allows it to serve as a valid tool to assess ERQ discriminant validity against (Hofmann & Kashdan, 2010). As expected, Hofmann and Kashdan (2010) found that the adjustment subscale of the ASQ correlated strongly with the reappraisal subscale of the ERQ ($r = 0.54$), and the concealment subscale of the ASQ correlated equally strong with the suppression subscale of the ERQ ($r = 0.60$). Similar findings were replicated in a second undergraduate sample (Hofmann & Kashdan, 2010). For the purposes of this study, the internal consistencies of the two subscales of interest, that is, concealing ($\alpha = 0.79$) and adjusting ($\alpha = 0.85$) where satisfactory. The total scale was also deemed satisfactory ($\alpha = 0.83$).

**Center for Epidemiologic Studies – Depression Scale.** The Center for Epidemiologic Studies – Depression Scale (CES-D: Radloff, 1977) is a 20-item scale that assesses six domains of depression. Items assessing depressed mood (e.g., “I felt depressed’), feelings of guilt and worthlessness (e.g., “I felt I was just as good as other people”), feelings of helplessness and hopelessness (e.g., “I felt hopeful about the future”), psychomotor retardation (e.g., “I felt that everything I did was an effort”), loss of appetite (e.g., “I did not feel like eating; my appetite was poor”), and sleep disturbance (e.g., “my sleep was restless”) within the past week are rated on a 4-point Likert-type scale (ranging from 0 = rarely or none of the time to 4 = most or all of the time). The initial development of the CES-D was tailored towards the general population. Radloff (1977) found high internal consistencies with Cronbach’s alpha coefficients ranging from 0.85 to 0.90 across studies (Radloff, 1977). Radloff (1977) also noted that the CES-D had acceptable test-retest stability, excellent concurrent validity, and substantial evidence for construct validity. Support for the use of the CES-D in older adult populations also
exists (e.g., Hertzog, Van Alstine, Usala, Hultsch, & Dixon, 1990; Lewinsohn, Seeley, Roberts, & Allen, 1997). Lewinsohn and colleagues (1997) reported no differences between gender and CES-D scores in community-residing older adult populations. Internal consistency scores of 0.83 (50-59 years of age), 0.83 (60-69 years of age), and 0.78 (70+ years of age) along with a total sample alpha of 0.82 were also reported (Lewinsohn et al., 1997). McCallum and colleagues (1995) concluded that the CES-D is robust to minor changes and further recommended its use in (cross-cultural) studies of depression in elderly persons. In this study, internal consistency of the CES-D was deemed strong for both Study 1 ($\alpha = 0.91$) and Study 2 ($\alpha = 0.93$).

**Emotion Regulation Questionnaire.** The Emotion Regulation Questionnaire (ERQ: Gross & John, 2003) is a commonly used measure of ER that has been translated and validated for use in several languages (e.g., Balzarotti et al., 2010; Masumoto, Taishi, & Shiozaki, 2016; Sala et al., 2012; Wiltink et al., 2011). The ERQ was used to assess the degree to which respondents typically try to control their emotional expression and experience. Respondents can rate on a 7-point Likert scale (ranging from 1 = strongly disagree to 7 = strongly agree) their responses to 10 items on the ERQ. The ERQ is comprised of two subscales, that is, cognitive reappraisal (4-items) and expressive suppression (6-items). Elevated scores on each subscale reflect a higher likelihood of using that respective ER strategy. Original investigations yielded moderate internal consistencies for the reappraisal subscale ($\alpha = 0.71$) and the suppression subscale ($\alpha = 0.69$). A single investigation of the ERQ in healthy community dwelling adults aged 50 years and older revealed satisfactory alphas for the reappraisal (0.83) and suppression (0.74) subscales (de Frias, 2014). Confirmatory factor analysis of the measure in a large
undergraduate sample supported the original 2-factor structure of the ERQ (Melka et al., 2011). Even though the ERQ is designed to measure expressive forms of suppression, investigations comparing this form to thought suppression have demonstrated minimal difference between the two in that both effect later appraisal of pain similarly (Quartana & Burns, 2007, see also Burns et al., 2007 for further discussion). Internal consistency of the reappraisal subscale in this study ranged from 0.88 (Study 1) and 0.86 (Study 2). Internal consistency of the suppression subscale ranged from 0.72 (Study 1) and 0.80 (Study 2). These reliability statistics were consistent with previous investigations. Total ERQ scale internal consistency ranged from 0.75 in Study 1 to 0.78 in Study 2, and were deemed acceptable.

**Penn State Worry Questionnaire-Abbreviated.** The Penn State Worry Questionnaire-Abbreviated (PSWQ-A: Hopko et al., 2003) is an 8-item questionnaire that measures worry using Likert-scale rating from 1 (not at all typical of me) to 5 (very typical of me). The PSWQ-A is a shorter version of the original 16-item PSWQ (Meyer, Miller, Metzger, & Borkovec, 1990). The original PSWQ has demonstrated adequate validity and reliability; however, concerns about the generalizability of the measure to older adults have been raised (e.g., Hopko et al., 2003). Hopko and colleagues (2003) noted that factor analysis of the PSWQ in older adult samples yielded data that did not fit with the traditional single and two-factor models of the measure. While Beck and colleagues (1995) found that the established 2-factor model fit well with both clinical and non-clinical older adult populations (aged 55-82 years), Brown (2003) cited the positive and negative structure of the items within the original PSWQ as being one of the primary reasons for this finding. The PSWQ-A is a revised unidimensional model (breadth and
control of worry) based on the original PSWQ. Sample items include “my worries overwhelm me” and “I have been a worrier all of my life”. Hopko and colleagues (2003) determined that the 8-item PSWQ-A was highly correlated with the original PSWQ ($r = 0.92$). Internal consistency of the PSWQ-A ($\alpha = 0.87$) was stronger than previous studies reporting internal consistencies of the original PSWQ with older adult samples (Hopko et al., 2003). Crittendon and Hopko (2006) found strong evidence for the utility of the PSWQ-A for use with older and younger adults. Internal consistency of the PSWQ-A was strong in both the older ($\alpha = 0.89$) and younger adult samples ($\alpha = 0.94$). Two-week test-retest reliability for older adults ($r = 0.92$) and younger adults ($r = 0.87$) was also strong (Crittendon & Hopko, 2006). The researchers also found sufficient evidence for construct validity of the single-factor PSWQ-A within both populations (Crittendon & Hopko, 2006). The PSWQ-A had a strong internal consistency in Study 1 ($\alpha = 0.94$) and Study 2 ($\alpha = 0.96$) similar to previous investigations.

**Analyses**

The participant data were examined with respect to relevant demographic variables (i.e., age, gender). Specifically, the online sample and the community sample were compared for group demographic differences. Significant outliers were addressed prior to evaluating the measures and were replaced by a value that was one lower or higher than the next closest value (Tabachnick & Fidell, 2013). Since the two samples do not significantly differ in terms of demographic variables and questionnaire scores, they were combined for a single analysis. Classical test theory was an ideal approach given the smaller samples size recruited in this study. Item level analysis using a classical test theory approach was used to explore corrected item-total correlations for both subscales
of the ERQ. Consistent with Field (2009), corrected item-total correlations of $r \leq 0.30$ were deemed poor items and considered for removal from the measure prior to use in Study 2.

**Validity analyses.** Validity analysis (discriminant and convergent) was completed by comparing the correlations of the ERQ with the ASQ, CES-D, and the PSWQ. Using the correction for attenuation formula as described by John and Benet-Martinez (2000), coefficients of $r \geq 0.30$ consistent with Cohen’s (1988) interpretations of correlation sizes was employed for determining whether a moderate to strong relationship exists between variables of interest (i.e., convergent validity). Correlations of $r < 0.30$ after being corrected for attenuation were deemed acceptable evidence for the existence of divergent validity.

**Study 2: Purpose**

The purpose of this study was to examine the construct validity of the ERQ while also exploring the emotion-chronic pain dynamic with particular focus on comparing male and female older adults to their younger adult counterparts. The main goals of this second study was to explore the use of ER strategy (i.e., suppression or reappraisal) and its effect on fear of pain, pain catastrophizing, and pain intensity within older and younger adult chronic pain populations.

**Study 2: Hypotheses**

It is well established in the pain literature that a predictive relationship exists between pain intensity, fear of pain, demographic variables of interest (e.g., gender) and pain catastrophizing (e.g., Leung, 2012; Sullivan et al., 1995; Keefe et al., 2000). Moreover, using Ong and colleagues (2010) empirically supported conceptualization for
measuring pain catastrophizing as an outcome variable in chronic pain populations, it was first hypothesized that a predictive relationship would exist between pain outcomes (i.e., pain intensity and fear of pain), demographic variables of interest (i.e., gender), and scores obtained on a measure of pain catastrophizing (e.g., Leung, 2012; Sullivan et al., 1995; Keefe et al., 2000). Given that the nature of pain within the study population was not limited to a specific type (e.g., dental pain) or acute pain following noxious stimulation, age was not expected to predict scores on a non-situation specific measure of pain catastrophizing (e.g., Keefe & Williams, 1990; Turner, Mancl, & Aaron, 2004; Ruscheweyh et al., 2011). Second, consistent with Campbell-Sills and colleagues (2006a) it was hypothesized that, irrespective of gender, reappraisal would negatively associate with fear of pain, pain catastrophizing, general worry, depression, and pain intensity whereas use of suppression would be associated positively with self-reported fear of pain, general worry, depression, pain catastrophizing, and pain intensity. Third, in accordance with biopsychosocial models of pain (e.g., Hadjistavropoulos et al., 2011) and pain-emotion dynamic research (Lumley et al., 2011) it was expected that both ER strategies (i.e., reappraisal and suppression) regardless of gender or age, would mediate the relationship between independent pain variables of interest (e.g., fear of pain, pain intensity) and pain catastrophizing as a dependent variable. See Figures 1 and 2 for a representation of these relationships. Finally, after testing of all hypotheses, exploratory analysis was undertaken in order to determine whether any differences in ERQ response style exist between the gender and age groups (older and younger adults) as has been demonstrated in previous research (e.g., Burns et al., 2010; John & Gross, 2004; Nolen-Hoeksema & Aldao, 2011). Furthermore, confirmation of the hypothesized relations of
ER approaches with the other variables under investigation would provide support for the construct validity of the tool.

**Study 2: Methods**

**Participants**

A total of 511 individuals (257 older adults and 254 younger adults) participated in the second study. Participants were recruited entirely through Qualtrics online research panels. All participants (i.e., older and younger adults) were recruited through Qualtrics research panels (http://www.Qualtrics.com) in order to maximize sample representativeness and study participating rates (see Bonk, 2010; Hawranik & Pangman, 2002; as well as McHenry et al., 2015 and McMurdo et al., 2011 for discussions on research recruitment challenges involving older adult populations). Participants were compensated for their time by Qualtrics. Qualtrics research panels are a well-established method of participant recruitment for researchers and online study surveys can be created consistent with recommendations made by King and colleagues (2014). Qualtrics research panels have been successfully used in previous chronic pain research (e.g., Ammaturo, Hadjistavropoulos, & Williams, 2017). The Qualtrics research panel system provided access to participants from across North America, with more diverse demographic features than could be found locally. Demographic information collected is verified by Qualtrics in order to protect against misrepresentation of study participant demographic data. All participants in Study 2 completed an online consent form (Appendix C) prior to responding to questionnaires uploaded to the Qualtrics website. All identifying information (i.e., internet protocol address) were kept separate from data to prevent any identification of participants.
Consistent with Gosling and Colleagues (2004), and as previously demonstrated in Study 1, online recruitment was deemed acceptable since participant responses did not differ from traditional methods of recruitment. Similar to Study 1, recommendations by King and colleagues (2014) were followed for online recruitment and data collection. Adequacy of sample size, with 138 participants needed for medium effect size, power set at 0.80, and an alpha level of 0.05, was confirmed using G*Power version 3 (Faul, Erdenfelder, Lang, & Buchner, 2007). The analysis requiring the greatest number of participants, regression (with 8 total predictors), was used to calculate power.

**Procedure**

Participants were asked to complete online measures of pain intensity, ER, fear associated with pain, and pain catastrophizing, and the same worry (PSWQ-A), depression (CES-D), and demographic questionnaire presented in Study 1.

**Measures**

**Shortened Version of the Fear of Pain Questionnaire – III.** The Shortened Version of the Fear of Pain Questionnaire – III (SVFPQ-III: Albaret, Muñoz Sastre, Cottencin, & Mullet, 2004; McNeil & Rainwater, 1998) is a 15-item shortened version of the original 30-item measure designed to assess trait-like fear of pain responses across three pain stimulus situations: Fear related to severe pain, fear related to minor pain, and fear related to medical pain. The three pain stimulus situations constitute three unique subscales comprised of 5-items each. Items are scored on a 5-point Likert-type scale (ranging from 1 = not at all to 5 = extreme). The SVFPQ-III approaches measurement of pain-related fear with the assumption that fear is specific to particular stimuli and context and as a result, a variety of pain and painful stimulus situations were incorporated into the
measure, making it possible to use with both pain and nonpain populations. The initial 30-item measure was validated in a sample of undergraduates and demonstrated satisfactory internal consistency for all subscales ($\alpha = 0.87-0.88$) and total scale score ($\alpha = 0.92$). Test-retest reliability for the subscales ($r = 0.69-0.76$) and total scale score ($r = 0.74$) were also adequate (McNeil & Rainwater, 1998). Albaret and colleagues (2004) determined that the original 3-factor structured was retained in a 15-item shortened version of the measure which yielded adequate reliability for all three scales in a sample of younger ($\alpha = 0.80-0.85$) and older adults ($\alpha = 0.76-0.86$). In this study, only the overall total scale score was of interest, and the internal consistency of the SVFPQ-III was deemed satisfactory ($\alpha = 0.89$).

**McGill Pain Questionnaire Short Form.** The McGill Pain Questionnaire Short Form (SFMPQ: Melzack, 1987) assesses pain qualities through 11 sensory (e.g., stabbing) and 4 affective (e.g., fearful) words. These words are rated on a 4-point Likert-type scale (ranging from 0 = none to 3 = severe). Moreover, the measure includes a Visual Analog Scale for pain intensity and a verbal descriptor scale for present pain. Initial investigations of the SFMPQ demonstrated poor test-retest reliability (Grönblad, Lukinmaa, & Konttinen, 1990). However, recent investigations have shown that the measure has adequate reliability with adults ranging in age from 31-81 years of age (mean age = 64.8 years). The high intraclass correlation coefficients ranged from 0.88 to 0.96 for the SFMPQ total score and the sensory, affective, and pain intensity dimensions suggesting that the SFMPQ is a highly reliable (Grafton, Foster, & Wright, 2005). In addition, Wright, Asmundson, and McCreary (2001) assessed the factorial validity of the SFMPQ and determined that it comprised of two factors consistent with the original
conceptual structure. The SFMPQ is a popular measure and has also been used successfully with older adults with chronic pain (e.g., Camacho-Soto, Sowa, Perera, & Weiner, 2012; Helme, Katz, Gibson, & Corran, 1989; Sherman, 2003). In this study, the subscale internal consistencies of interest were satisfactory and ranged from 0.82 (affective dimensions subscale) to 0.83 (sensory dimensions subscale). The total SFMPQ scale ($\alpha = 0.89$) was also deemed satisfactory.

**Pain Catastrophizing Scale.** The Pain Catastrophizing Scale (PCS: Sullivan, et al., 1995) is used to assess catastrophizing cognitions in relation to pain. The 13-item PCS requires respondents to reflect on past painful experiences and to indicate the frequency with which they experienced each thoughts or feelings associated with pain (1 thought per scale item). The scale uses a 5-point Likert scale (0 = not at all, and 4 = all the time). Maximum total score on the PCS is 52. The PCS has demonstrated adequate internal consistency ($\alpha = 0.87$), and test retest reliability ($r = 0.75$). In a sample of Canadian older adults (aged 65+ years) the PCS demonstrated satisfactory internal consistency ($\alpha = 0.86$). In this study, the overall the PCS total scale score was found to be strong ($\alpha = 0.94$).

**Analyses**

With respect to the first hypothesis, it is imperative that a relationship between pain outcomes (i.e., pain intensity and fear of pain), demographic variables of interest (e.g., gender) and scores obtained on a measure of pain catastrophizing are found consistent with Leung (2012), Sullivan and colleagues (1995), and Keefe and colleagues (2000) as well as others (e.g., Keefe & Williams, 1990; Turner, Mancl, & Aaron, 2004; Ruscheweyh et al., 2011). It is important that these predictive relationships hold true for
our combined older and younger adult sample. To test this, a single regression analysis was completed with PCS total scores representing the dependent variable within the regression. Demographic variables of interest (i.e., participant age, relationship status, number of months living with pain, and gender) as well as CES-D, PSWQ-A, SFMPQ and SVFPQ-III total scores represented independent variables within the regression model. In order to test the second hypothesis (i.e., the relationships of each ER strategy to self-reported fear of pain, general worry, depression, pain catastrophizing, and pain intensity), five separate regression analyses were conducted to examine whether subscales of the ERQ (Gross & John, 2003) and/or other demographic characteristics explain significant variance within the SFMPQ (Melzack, 1987), PCS (Sullivan et al., 1995), SVFPQ-III (Albaret et al., 2004; McNeil & Rainwater, 1998), PSWQ-A (Hopko et al., 2003), and CES-D (Radloff, 1977) outcome scores. If any of the five overall models were determined to be significant, each variable’s unique contribution to the regression would be further examined using a conservative approach in which each predictor’s ability to account for unique variance is examined after all other predictors have been entered into the model. Within each of the five regression models, ERQ suppression and reappraisal subscale scores as well as demographic variables (i.e., participant age, relationship status, number of months living with pain, and gender) were included as independent variables, while CES-D total scale score, PSWQ-A total scale score, PCS total scale score, SVFPQ-III total scale score, and SFMPQ total scale score represented five separate dependent variables of interest. Mediation analyses allowed for the testing of the third hypothesis (see Figure 1 and 2). Such an approach permitted for the testing of the mediating effects of the two regulation strategies (suppression and reappraisal) on
the relationship between fear of pain (SVFPQ-III total scale score as independent variable) and pain catastrophizing (PCS total scale score as dependent variable) as well as pain intensity (SFMPQ affective pain subscale and sensory pain subscale as independent variables) and pain catastrophizing (PCS total scale score as dependent variable) across both younger and older adults separately. These six unique models per age group (please see Figures 1 and 2) are: A) Suppression mediating between SVFPQ-III total scale score and PCS total scale score; B) suppression mediating between SFMPQ sensory pain subscale score and PCS total scale score; C) suppression mediating between SFMPQ affective pain subscale score and PCS total scale score; D) reappraisal mediating between SVFPQ-III total scale score and PCS total scale score; E) reappraisal mediating between SFMPQ sensory pain subscale score and PCS total scale score; and F) reappraisal mediating between SFMPQ affective pain subscale score and PCS total scale score. Consistent with Hayes (2009), Preacher and Hayes (2008), and Preacher and Hayes (2004) the hypothesized models were tested using bootstrapping significance tests, with $n = 5000$ bootstrap resamples in order to assess suppression and reappraisal as independent mediators of the relationship between PCS scores and pain intensity (SFMPQ scores) as well as PCS scores and fear of pain (SVFPQ-III scores). All mediation analyses were completed using Hayes’ (2013) PROCESS version 2 macro for SPSS (http://www.processmacro.org/index.html). This macro can assist in computation of unstandardized model coefficients, standard errors, $t$ and $p$-values, and confidence intervals using ordinary least squares regression for continuous outcomes or maximum likelihood logistics regressions for dichotomous variables (Hayes, 2013). PROCESS generates direct and indirect mediation model effects with single or multiple mediators.
Using PROCESS allowed for bias-corrected bootstrapping and Monte Carlo confidence intervals to be generated for indirect effects (see Hayes 2013, for specific PROCESS macro coding and specification details). Bootstrapped confidence intervals were used to evaluate the statistical significance of the mediated models. Bootstrapping has the highest power and the best Type I error control as compared to Sobel test and Baron and Kenny’s (1986) approaches to mediation analysis. Moreover, bootstrapping allowed for the testing of indirect effects even in the absence of significant total effects, thus further permitting for the evaluation of important and potentially useful mechanisms by which catastrophizing may be related to pain-related fear and intensity (Hayes, 2009). Thus, similar to Wong and Fielding (2013), a goal of this study was to evaluate the mediating role of ER strategies (i.e., suppression and reappraisal) on the independent relationship of pain intensity and pain-related fear with pain catastrophizing across both younger and older adults separately. Finally, exploratory comparisons were made between younger and older adults with respect to the ERQ. If demographic differences beyond age were found between the two groups (e.g., average length of time living with pain), they were considered for use as covariates within the main analysis. Analysis of variance (ANOVAs) with age grouping (older and younger adult) and gender (male or female) as the between subject factors were conducted with respect to ERQ responses in order to determine if age differences consistent with the socioemotional selectivity theory (Charles & Carstensen, 2007) and gender differences (e.g., Balzarotti et al.2010; Gross & John, 2003; Melka et al., 2011; Nolen-Hoeksema & Aldao, 2011; Spaapen et al., 2014; Wiltink et al., 2011) would be replicated within the combined younger and older adult chronic pain population in this study.
Figure 1

*Representation of Emotion Regulation Suppression Mediation Models*

![Diagram of Emotion Regulation Suppression Mediation Models]

**A. Fear of Pain**
- ERQ Suppression Score
- SVFPQ-III Total Score
- PCS Total Score

**B. Sensory Dimensions of Pain Intensity**
- ERQ Suppression Score
- SFMPQ Sensory Pain Subscale Score
- PCS Total Score

**C. Affective Dimensions of Pain Intensity**
- ERQ Suppression Score
- SFMPQ Affective Pain Subscale Score
- PCS Total Score

*Figure 1.* Representation of the hypothesized emotion regulation suppression mediation models. PCS = Pain Catastrophizing Scale (Sullivan et al., 1995); SVFPQ-III = Shortened Version of the Fear of Pain Questionnaire – III (Albaret et al., 2004; McNeil & Rainwater, 1998); SFMPQ = McGill Pain Questionnaire Short Form (Melzack, 1987); ERQ = Emotion Regulation Questionnaire (Gross & John, 2003).
Representation of Emotion Regulation Reappraisal Mediation Models

Figure 2. Representation of the hypothesized emotion regulation reappraisal mediation models. PCS = Pain Catastrophizing Scale (Sullivan et al., 1995); SVFPQ-III = Shortened Version of the Fear of Pain Questionnaire – III (Albaret et al., 2004; McNeil & Rainwater, 1998); SFMPQ = McGill Pain Questionnaire Short Form (Melzack, 1987); ERQ = Emotion Regulation Questionnaire (Gross & John, 2003).
Study 1: Results

Missing Data, Outliers, and Distribution Analyses

Missing data were addressed using mean replacement for Likert-type scale items. This method leads to a good representation of the original data when the number of respondents with missing data is less than 20% of the sample size per variable of interest (Downey & King, 1998). At the subscale level, mean replacement was used to address missing data only when the omitted value(s) represented 20% or less of the overall scale items. Questionnaire distributions were checked for outliers, which were replaced by a value that was one lower or higher than the next non-outlier extreme value (Tabachnick & Fidell, 2013). A single online-respondent outlier was identified and replaced for the ERQ reappraisal subscale score. Normality of data (i.e., skewness and kurtosis) was examined both statistically and graphically in a manner consistent with Tabachnick and Fidell’s (2013) recommendations. Data normality for Study 1 measures were deemed acceptable using a conventional but conservative (i.e., 0.001, two-tailed) alpha level in order to examine the significance of both skewness and kurtosis with small to moderate sample sizes (Tabachnick and Fidell, 2013).

Demographic Analyses

A sample of 83 older adults (36 men, 47 women) participated in this study. Participants were recruited from a variety of Canadian provinces including Alberta (15.7%), British Columbia (15.7%), Manitoba (3.0%), Newfoundland (1.2%), Nova Scotia (3.6%), Ontario (6.0%), Prince Edward Island (1.2%), and Saskatchewan (53.0%). Of the 43 Saskatchewan participants, a sub-sample ($n = 26$) who resided locally completed their questionnaires in paper and pencil hardcopy format. All other
participants completed their questionnaires online through a dedicated Survey Monkey website (www.Surveymonkey.ca).

Participants ranged in age from 65-92 years ($M = 72.57; SD = 6.75$). Participants who completed their questionnaires online were on average younger ($M = 69.63; SD = 3.96$) than those who completed the questionnaires using hardcopy format ($M = 78.92; SD = 7.19$), $t(80) = -7.55, p < 0.001$. In terms of relationship status participants reported they were married (63.9%), single (1.2%), in a common law relationship (1.2%), separated and/or divorced (21.7%), or widowed (10.8%). Chi square analysis demonstrated that the percentage of participants who completed the questionnaires online versus paper and pencil, did not differ in terms of relationship status, $\chi^2(5, n = 82) = 9.25, p = 0.10$. A majority of participants (63.4%) reported currently living with pain for a period ranging from 3 months to 74.33 years ($M = 13.73, SD = 14.92$). Participants who completed hardcopy (i.e., paper package) versions of the questionnaires reported living with pain ($M = 22.31, SD = 18.95$) for a longer duration (calculated in years) than online participants ($M = 8.65, SD = 8.96$), $t(41) = -3.21, p = 0.003$. Overall, 68.6% of the older adult participants living with some form of pain (i.e., chronic or acute) reported taking medication for their condition. A total of 35 participants (54.3% online and 45.7% paper hardcopy respondents) with pain reported using a pharmacological intervention to manage their pain, and this difference was found to be significant, $\chi^2(1, n = 82) = 4.94, p = 0.026$. Despite these results, Fisher’s $Z_r$ transformation (i.e., Corey, Dunlap, & Burke, 1998; Fisher, 1921) analysis revealed that the difference between the correlations of length of time living with pain and the use of pharmacological aides by hardcopy and online participants to manage pain was not significant across the two data collection
strategies. Table 1 presents the means and standard deviations of the participant’s responses on the study questionnaires. There were no significant differences between the online and paper package groups (see Table 1). Since participant responses did not differ significantly across the two study response protocols, all further analysis reported includes participants’ responses collapsed across hardcopy as well as online conditions.

**Internal Consistency and Item Analysis**

It was expected that the ERQ would demonstrate adequate psychometric properties. The internal consistency (Cronbach’s alpha) of the ERQ reappraisal subscale was 0.88. The internal consistency of the ERQ suppression subscale was 0.72. Item level analysis using a classical test theory approach was undertaken to explore corrected item-total correlations for both subscales of the ERQ. Consistent with Field (2009), corrected item-total correlations of $r \leq 0.30$ are deemed poor items and were considered for removal. With respect to the ERQ reappraisal subscale, all six item-total correlations ranged between $r = 0.62$ and $r = 0.81$. Similarly, with respect to the ERQ suppression subscale, all four scale item-total correlations ranged between $r = 0.39$ and $r = 0.64$. As such, no items were removed from either subscale of the ERQ.

**Convergent and Discriminant Validity**

Participant scores on ERQ suppression and reappraisal subscales were expected to demonstrate adequate discriminant validity (i.e., $r < 0.30$) when correlated with the CES-D and the PSWQ-A total scores respectively. Consistent with this expectation, the suppression subscale of the ERQ did not correlate strongly with the CES-D total score, $r(74) = 0.28$, $p = 0.013$. This was also the case with respect to the PSWQ-A total score, $r(74) = 0.20$, $p = 0.087$. Similarly, the reappraisal subscale of the ERQ did not correlate
Table 1

*Scale Scores and Independent T-Tests Comparing Online Versus Paper and Pencil Participant Responses Across Different Measures*

<table>
<thead>
<tr>
<th>Scale</th>
<th>Paper Package</th>
<th>Online</th>
<th>Comparison</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>n</td>
<td>M (SD)</td>
</tr>
<tr>
<td>ERQ Reappraisal Subscale</td>
<td>30.77 (5.43)</td>
<td>26</td>
<td>30.38 (6.86)</td>
</tr>
<tr>
<td>ERQ Suppression Subscale</td>
<td>15.23 (4.66)</td>
<td>26</td>
<td>14.85 (5.24)</td>
</tr>
<tr>
<td>ASQ Adjustment Subscale</td>
<td>23.76 (5.03)</td>
<td>26</td>
<td>23.99 (5.11)</td>
</tr>
<tr>
<td>ASQ Concealment Subscale</td>
<td>24.34 (5.64)</td>
<td>26</td>
<td>24.26 (5.63)</td>
</tr>
<tr>
<td>ASQ Tolerance Subscale</td>
<td>16.58 (3.90)</td>
<td>26</td>
<td>17.09 (3.17)</td>
</tr>
<tr>
<td>CES-D Total Score</td>
<td>13.40 (9.74)</td>
<td>26</td>
<td>12.70 (10.41)</td>
</tr>
<tr>
<td>PSWQ-A Total Score</td>
<td>18.27 (8.86)</td>
<td>26</td>
<td>17.12 (6.87)</td>
</tr>
</tbody>
</table>

*Note.* ERQ = Emotion Regulation Questionnaire, ASQ = Affective Style Questionnaire, CES-D = Center for Epidemiological Studies – Depression Scale, PSWQ-A = Penn State Worry Questionnaire – Abbreviated.
strongly with the CES-D total score, \( r(74) = -0.20, p = 0.083 \) nor with the PSWQ-A total score, \( r(74) = -0.010, p = 0.371 \).

In terms of convergent validity, it was expected that the ERQ suppression and reappraisal subscales would be highly correlated (i.e., \( r \geq 0.30 \)) with the ASQ concealing and adjusting subscales respectively. Consistent with expectations, the suppression subscale of the ERQ correlated strongly and significantly with the ASQ concealment subscale score, \( r(76) = 0.51, p < 0.001 \). Similarly, the reappraisal subscale of the ERQ correlated significantly (albeit not as strongly as predicted) with the ASQ adjustment subscale score, \( r(77) = 0.41, p < 0.001 \).

### Study 2: Results

#### Missing Data and Outliers

There were no missing data for Study 2 questionnaires given that data collection was completed through Qualtrics research panels and omitted responses are flagged for participants to review. Similar to Study 1, the data was checked for outliers separately for both older and younger adult questionnaire distributions. Outliers were replaced by a value that was one lower or higher than the next non-outlier extreme value (Tabachnick & Fidell, 2013). Scores from a single older adult and two younger adult outliers were identified and replaced for the ERQ reappraisal subscale score. In addition, when scale responses were analyzed for outliers across the entire sample, the same original three outliers were identified consistent with the separate age-group analysis.

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1. Biserial correlations revealed that the ERQ suppression and reappraisal subscales were not significantly associated with the PSWQ-A total score nor with the CES-D total score at the 0.01 level (2-tailed).
2. Biserial correlations revealed a statistically significant (2-tailed) association between the ERQ suppression subscale and ASQ concealment subscale at the 0.01 level. The ERQ suppression subscale was not significantly associated with the ASQ adjustment subscale. The ERQ reappraisal subscale was significantly associated with the ASQ adjustment subscale at both the 0.01 level. The ERQ reappraisal subscale was not significantly associated with the ASQ concealment subscale.
Data distribution and normality. Normality was examined through graphical representation of the data as recommended for larger sample sizes (Tabachnick & Fidel, 2013). In large samples consistent with this study, statistical significance of skewness and kurtosis is considered to be an unreliable estimate of normality. This is primarily owing to the increasingly smaller standard errors that are associated with larger samples (Tabachnick & Fidell, 2013). In such cases, a greater chance exists of obtaining statistically significant skewness and kurtosis. Graphical examination of older adult, younger adult, and combined response distributions revealed satisfactory skewness and kurtosis for all relevant study subscales and questionnaires. In addition, all transformation methods as outlined by Tabachnick and Fiddell (2013) were found not to improve graphical representations of overall data distribution skewness and kurtosis. Therefore, analyses were conducted on the untransformed data.

Tests of Hypothesized Relationships

A total of 511 individuals participated in this study including 257 older adults (128 men, 129 women) and 254 younger adults (124 men, 130 women). Table 2 presents demographic characteristics of older and younger adult participants. Table 3 presents means and standard deviations of the participant’s responses on the study questionnaire scales.

Chi square analysis demonstrated that the older and younger adults differed in terms of self-reported use of some form of pharmacological intervention for their pain, \( \chi^2(1, n = 511) = 19.24, p < 0.001; \) however, this data was not quantified statistically since most participants failed to provide accurate supplemental details and/or failed to respond to additional medication queries altogether. Participant’s self-reported responses to
<table>
<thead>
<tr>
<th>Scale</th>
<th>Older Adults</th>
<th>Younger Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>%</td>
</tr>
<tr>
<td>Age</td>
<td>70.25 (5.01)</td>
<td>-</td>
</tr>
<tr>
<td>Relationship Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>-</td>
<td>58.8</td>
</tr>
<tr>
<td>Single</td>
<td>-</td>
<td>4.3</td>
</tr>
<tr>
<td>Common Law</td>
<td>-</td>
<td>2.3</td>
</tr>
<tr>
<td>Separated/Divorced</td>
<td>-</td>
<td>17.5</td>
</tr>
<tr>
<td>Widowed</td>
<td>-</td>
<td>17.1</td>
</tr>
<tr>
<td>Duration of Chronic Pain in Months</td>
<td>95.55 (125.96)</td>
<td>-</td>
</tr>
<tr>
<td>Currently Taking Pain Medication</td>
<td>-</td>
<td>64.2</td>
</tr>
</tbody>
</table>

*Note.* Older adults ranged in age from 65-88 years, while younger adults ranged in age from 18-35 years. Older adults reported duration of current pain range of 3-780 months, while younger adults reported between 3-240 months.
Table 3

Study 2 Scale Scores for Older and Younger Adult Participants

<table>
<thead>
<tr>
<th>Scale</th>
<th>Older Adults</th>
<th>Younger Adults</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERQ Reappraisal Subscale</td>
<td>29.58 (5.92)</td>
<td>29.63 (6.48)</td>
</tr>
<tr>
<td>ERQ Suppression Subscale</td>
<td>15.86 (4.97)</td>
<td>16.45 (5.36)</td>
</tr>
<tr>
<td>SVFPQ-III Total Score</td>
<td>36.91 (10.76)</td>
<td>39.80 (11.37)</td>
</tr>
<tr>
<td>PCS Total Score</td>
<td>17.53 (10.08)</td>
<td>24.06 (12.07)</td>
</tr>
<tr>
<td>SFMPQ Total Score</td>
<td>17.62 (9.07)</td>
<td>20.21 (9.18)</td>
</tr>
<tr>
<td>SFMPQ Sensory Pain Subscale</td>
<td>13.78 (6.39)</td>
<td>15.46 (6.48)</td>
</tr>
<tr>
<td>SFMPQ Affective Pain Subscale</td>
<td>3.82 (3.20)</td>
<td>4.74 (3.34)</td>
</tr>
<tr>
<td>CES-D Total Score</td>
<td>14.88 (11.42)</td>
<td>24.10 (12.43)</td>
</tr>
<tr>
<td>PSWQ-A Total Score</td>
<td>18.84 (8.93)</td>
<td>25.89 (8.89)</td>
</tr>
</tbody>
</table>

medication management use for their pain was considered for exploratory analysis as a potential covariate.

**Prediction of pain catastrophizing.** In order to determine whether SFMPQ total scale score and the SVFPQ-III total scale score predicted PCS total scale score (consistent with the first hypothesis), a conservative regression analysis approach was utilized. Demographic characteristics (i.e., age, gender, relationship status, number of months living with pain) as well as self-reported depression (CES-D total scale score) and worry (PSWQ-A total scale score) were also entered in the regressions. Using this conservative regression analysis approach, the significance of the full model is examined first. If the full model is significant, each predictor’s ability to account for unique variance is examined after all the predictors are entered into the model. PCS total scale score was the dependent variables.

The intercorrelations of the regression variables are presented in Table 4. Both models were significant (i.e., the model including pain intensity and the model including fear of pain). The regression results are presented in Table 5.

The full model was statistically significant for pain catastrophizing (PCS total scale score), \( F(8,497) = 102.36, p < .001, R^2 = 0.62 \). An examination of each variable’s unique contribution to the prediction equation suggested that gender, SFMPQ total scale score, SVFPQ-III total scale score, CES-D total scale score, and the PSWQ-A total scale score made independent and unique contributions to the model (see Table 5). Participant gender, SFMPQ total scale score, SVFPQ-III total scale score, CES-D total scale score, and PSWQ-A total scale score accounted for approximately 0.4%, 10%, 4%, 1%, and 3% of the variance in PCS respectively. No other variables were significant.
Table 4

Correlation Matrix for the McGill Pain Questionnaire Short Form and the Shortened Version of the Fear of Pain Questionnaire – III

<table>
<thead>
<tr>
<th>Predictor</th>
<th>SFMPQ Total Scale Score&lt;sup&gt;a&lt;/sup&gt;</th>
<th>SVFPQ-III Total Scale Score&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Gender</th>
<th>Age Group</th>
<th>Relationship Status</th>
<th>PCS Total Scale Score&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Months Living With Pain</th>
<th>CES-D Total Scale Score&lt;sup&gt;b&lt;/sup&gt;</th>
<th>PSWQ-A Total Scale Score&lt;sup&gt;b&lt;/sup&gt;</th>
<th>ERQ Reappraisal Subscale Score&lt;sup&gt;b&lt;/sup&gt;</th>
<th>ERQ Suppression Subscale Score&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFMPQ Total Score</td>
<td>1.00</td>
<td>0.24**</td>
<td>0.07</td>
<td>0.14**</td>
<td>-0.03</td>
<td>0.66**</td>
<td>0.00</td>
<td>0.52**</td>
<td>0.41**</td>
<td>0.04</td>
<td>0.08</td>
</tr>
<tr>
<td>SVFPQ-III Total Score</td>
<td>1.00</td>
<td>0.17**</td>
<td>0.21**</td>
<td>-0.15**</td>
<td>0.39**</td>
<td>-0.08</td>
<td>0.19**</td>
<td>0.33**</td>
<td>0.09*</td>
<td>0.09*</td>
<td>0.05</td>
</tr>
<tr>
<td>Gender</td>
<td>1.00</td>
<td>0.01</td>
<td>0.13**</td>
<td>0.04</td>
<td>0.36**</td>
<td>0.14**</td>
<td>0.03</td>
<td>0.37**</td>
<td>0.00</td>
<td>0.06</td>
<td>-0.31**</td>
</tr>
<tr>
<td>Age Group</td>
<td>1.00</td>
<td>-0.60**</td>
<td>0.28**</td>
<td>-0.36**</td>
<td>0.36**</td>
<td>0.14**</td>
<td>0.03</td>
<td>0.37**</td>
<td>0.00</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>Relationship Status</td>
<td>1.00</td>
<td>-0.15**</td>
<td>0.24**</td>
<td>-0.20**</td>
<td>-0.22**</td>
<td>0.14**</td>
<td>0.03</td>
<td>-0.02</td>
<td>-0.14**</td>
<td>0.06</td>
<td>-0.14**</td>
</tr>
<tr>
<td>PCS Total Score</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.60**</td>
<td>0.59**</td>
<td>-0.04</td>
<td>0.16**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Months Living With Pain</td>
<td></td>
<td></td>
<td>1.00</td>
<td>-0.04</td>
<td>-0.06</td>
<td>0.69**</td>
<td>0.18**</td>
<td>-0.08</td>
<td>0.08</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CES-D Total Score</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td>0.69**</td>
<td>-0.18**</td>
<td>0.20**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSWQ-A Total Score</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td>-0.11*</td>
<td>0.08</td>
<td>0.11*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ERQ Reappraisal Subscale Score</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td>0.11*</td>
<td>0.08</td>
<td>0.11*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ERQ Suppression Subscale Score</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. SFMPQ = McGill Pain Questionnaire Short Form, SVFPQ-III = Shortened Version of the Fear of Pain Questionnaire – III, PCS = Pain Catastrophizing Scale, CES-D = Center for Epidemiological Studies – Depression Scale, PSWQ-A = Penn State Worry Questionnaire – Abbreviated. ** Correlation is significant at the 0.01 level (2-tailed); *Correlation is significant at the 0.05 level (2-tailed). <sup>a</sup>Hypothesis 1 dependent variable, <sup>b</sup>Hypothesis 2 dependent variable
Table 5

Pain Catastrophizing Scale Regression Results with all Hypothesized Demographic Predictors

<table>
<thead>
<tr>
<th>Predictor</th>
<th>$B$</th>
<th>$F$ (8,497)</th>
<th>$p$-value</th>
<th>$R^2$ Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>-0.065</td>
<td>5.14</td>
<td>0.024</td>
<td>0.004</td>
</tr>
<tr>
<td>Age Group</td>
<td>0.046</td>
<td>1.44</td>
<td>0.231</td>
<td>0.001</td>
</tr>
<tr>
<td>Relationship Status</td>
<td>0.007</td>
<td>0.04</td>
<td>0.842</td>
<td>0.001</td>
</tr>
<tr>
<td>Months Living With Pain</td>
<td>-0.023</td>
<td>0.63</td>
<td>0.429</td>
<td>0.000</td>
</tr>
<tr>
<td>CES-D Total Scale Score</td>
<td>0.172</td>
<td>16.70</td>
<td>0.000</td>
<td>0.013</td>
</tr>
<tr>
<td>PSWQ-A Total Scale Score</td>
<td>0.234</td>
<td>33.66</td>
<td>0.000</td>
<td>0.026</td>
</tr>
<tr>
<td>SFMPQ Total Scale Score</td>
<td>0.395</td>
<td>133.69</td>
<td>0.000</td>
<td>0.102</td>
</tr>
<tr>
<td>SVFPQ-III Total Scale Score</td>
<td>0.233</td>
<td>53.18</td>
<td>0.000</td>
<td>0.040</td>
</tr>
</tbody>
</table>

*Note.* SFMPQ = McGill Pain Questionnaire Short Form, SVFPQ-III = Shortened Version of the Fear of Pain Questionnaire – III, CES-D = Center for Epidemiological Studies – Depression Scale, PSWQ-A = Penn State Worry Questionnaire – Abbreviated.
**Emotion regulation and pain-related outcomes.** With respect to the second hypothesis, it is expected that the ERQ reappraisal subscale will negatively predict the following: 1) SVFPQ-III total scale score; 2) SFMPQ total scale score; 3) PCS total scale score; 4) CES-D total scale score; and 5) PSWQ-A total scale score. In contrast to reappraisal, the ERQ suppression subscale was expected to positively predict each of the five aforementioned scale scores. To test the second hypothesis, five separate regression analyses were completed using the same conservative regression approach described previously.

The intercorrelations of the regression variables are presented in Table 4. All five models were significant (i.e., the models including fear of pain, pain intensity, pain catastrophizing, depression, and worry). The regression results are presented in Tables 6, 7, and 8.

The full model was statistically significant for pain intensity (SFMPQ total scale score), $F(6, 499) = 3.70, p = 0.001, R^2 = 0.04$. An examination of each variable’s unique contribution to the prediction equation suggested that ERQ suppression subscale and participant age group both made independent and unique contributions to the model (see Table 6). The ERQ suppression subscale and participant age group accounted for approximately 1% and 3% of the variance in SFMPQ total scale score respectively. No other variables were significant.
Table 6

*McGill Pain Questionnaire Short Form and Pain Catastrophizing Scale Regression Results with Demographic and Emotion Regulation Predictors*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>B</th>
<th>F (6,499)</th>
<th>p-value</th>
<th>R² Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SFMPQ Total Scale Score</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>0.087</td>
<td>3.46</td>
<td>0.063</td>
<td>0.007</td>
</tr>
<tr>
<td>Age Group</td>
<td>0.212</td>
<td>13.74</td>
<td>0.000</td>
<td>0.026</td>
</tr>
<tr>
<td>Relationship Status</td>
<td>0.086</td>
<td>2.39</td>
<td>0.123</td>
<td>0.005</td>
</tr>
<tr>
<td>Months Living With Pain</td>
<td>0.066</td>
<td>1.99</td>
<td>0.159</td>
<td>0.004</td>
</tr>
<tr>
<td>ERQ Reappraisal Subscale</td>
<td>0.027</td>
<td>0.37</td>
<td>0.543</td>
<td>0.001</td>
</tr>
<tr>
<td>ERQ Suppression Subscale</td>
<td>0.099</td>
<td>4.45</td>
<td>0.035</td>
<td>0.009</td>
</tr>
<tr>
<td><strong>PCS Total Scale Score</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>0.084</td>
<td>3.51</td>
<td>0.062</td>
<td>0.006</td>
</tr>
<tr>
<td>Age Group</td>
<td>0.314</td>
<td>32.48</td>
<td>0.000</td>
<td>0.058</td>
</tr>
<tr>
<td>Relationship Status</td>
<td>0.046</td>
<td>0.75</td>
<td>0.387</td>
<td>0.001</td>
</tr>
<tr>
<td>Months Living With Pain</td>
<td>0.037</td>
<td>0.68</td>
<td>0.409</td>
<td>0.001</td>
</tr>
<tr>
<td>ERQ Reappraisal Subscale</td>
<td>-0.065</td>
<td>2.37</td>
<td>0.125</td>
<td>0.004</td>
</tr>
<tr>
<td>ERQ Suppression Subscale</td>
<td>0.182</td>
<td>16.63</td>
<td>0.000</td>
<td>0.029</td>
</tr>
</tbody>
</table>

*Note.* ERQ = Emotion Regulation Questionnaire, SFMPQ = McGill Pain Questionnaire Short, PCS = Pain Catastrophizing Scale.
Table 7

*Shortened Version of the Fear of Pain Questionnaire – III and Center for Epidemiological Studies – Depression Scale Regression Results with Demographic and Emotion Regulation Predictors*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>$B$</th>
<th>$F$ (6,499)</th>
<th>$p$-value</th>
<th>$R^2$ Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SVFPQ-III Total Scale Score</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>0.177</td>
<td>14.55</td>
<td>0.000</td>
<td>0.028</td>
</tr>
<tr>
<td>Age</td>
<td>0.121</td>
<td>4.51</td>
<td>0.034</td>
<td>0.009</td>
</tr>
<tr>
<td>Relationship Status</td>
<td>-0.013</td>
<td>0.06</td>
<td>0.815</td>
<td>0.000</td>
</tr>
<tr>
<td>Months Living With Pain</td>
<td>0.005</td>
<td>0.01</td>
<td>0.913</td>
<td>0.000</td>
</tr>
<tr>
<td>ERQ Reappraisal Subscale</td>
<td>0.067</td>
<td>2.32</td>
<td>0.129</td>
<td>0.004</td>
</tr>
<tr>
<td>ERQ Suppression Subscale</td>
<td>0.079</td>
<td>2.89</td>
<td>0.090</td>
<td>0.005</td>
</tr>
<tr>
<td><strong>CES-D Total Scale Score</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>0.079</td>
<td>3.48</td>
<td>0.063</td>
<td>0.005</td>
</tr>
<tr>
<td>Age Group</td>
<td>0.407</td>
<td>61.89</td>
<td>0.000</td>
<td>0.097</td>
</tr>
<tr>
<td>Relationship Status</td>
<td>0.043</td>
<td>0.73</td>
<td>0.392</td>
<td>0.001</td>
</tr>
<tr>
<td>Months Living With Pain</td>
<td>0.094</td>
<td>4.87</td>
<td>0.028</td>
<td>0.008</td>
</tr>
<tr>
<td>ERQ Reappraisal Subscale</td>
<td>-0.195</td>
<td>23.79</td>
<td>0.000</td>
<td>0.037</td>
</tr>
<tr>
<td>ERQ Suppression Subscale</td>
<td>0.229</td>
<td>29.40</td>
<td>0.000</td>
<td>0.046</td>
</tr>
</tbody>
</table>

Table 8

*Penn State Worry Questionnaire – Abbreviated Regression Results with Demographic and Emotion Regulation Predictors*

<table>
<thead>
<tr>
<th>Predictor</th>
<th>$B$</th>
<th>$F$ (6,499)</th>
<th>$p$-value</th>
<th>$R^2$ Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>0.186</td>
<td>18.70</td>
<td>0.000</td>
<td>0.030</td>
</tr>
<tr>
<td>Age Group</td>
<td>0.374</td>
<td>50.46</td>
<td>0.000</td>
<td>0.082</td>
</tr>
<tr>
<td>Relationship Status</td>
<td>-0.017</td>
<td>0.11</td>
<td>0.744</td>
<td>0.000</td>
</tr>
<tr>
<td>Months Living With Pain</td>
<td>0.073</td>
<td>2.81</td>
<td>0.094</td>
<td>0.005</td>
</tr>
<tr>
<td>ERQ Reappraisal Subscale</td>
<td>-0.138</td>
<td>11.41</td>
<td>0.001</td>
<td>0.019</td>
</tr>
<tr>
<td>ERQ Suppression Subscale</td>
<td>0.126</td>
<td>8.54</td>
<td>0.004</td>
<td>0.014</td>
</tr>
</tbody>
</table>

*Note.* ERQ = Emotion Regulation Questionnaire, PSWQ-A = PSWQ-A = Penn State Worry Questionnaire – Abbreviated.
The full model was statistically significant for pain catastrophizing (PCS total scale score), $F(6, 499) = 10.87, p < 0.001, R^2 = 0.12$. Examination of each variable’s unique contribution to the prediction equation suggested that ERQ suppression subscale and participant age group both made independent and unique contributions to the model (see Table 6). The ERQ suppression subscale accounted for approximately 3% of the variance in PCS total scale score while participant age group accounted for an additional 6% of the variance in PCS total scale score. No other variables were significant.

The full model was statistically significant for fear of pain (SVFPQ-III total scale score), $F(6, 499) = 4.67, p < 0.001, R^2 = 0.05$. An examination of each variable’s unique contribution to the prediction equation unexpectedly revealed that only participant gender and participant age group made independent and unique contributions to the model (see Table 7). Participant gender accounted for approximately 3% while participant age group accounted for nearly 1% of the variance in SVFPQ-III total scale scores. No other variables were significant.

The full model was statistically significant for depression (CES-D total scale score), $F(6, 499) = 22.95, p < 0.001, R^2 = 0.22$. An examination of each variable’s unique contribution to the prediction equation suggested that consistent with the study hypothesis, ERQ reappraisal subscale score and ERQ suppression subscale score both made independent and unique contributions to the model (see Table 7). Participant age group and the number of months living with pain also made independent and unique contributions to the model. The number of months living with pain, ERQ reappraisal subscale score, ERQ suppression subscale score, and participant age group accounted for
approximately 1%, 4%, 5%, and 10% of the variance in CES-D total scores respectively. No other variables were significant.

The full model was statistically significant for worry (PSWQ-A total scale score), $F(6,499) = 19.56, p < 0.001, R^2 = 0.19$. Examination of each variable’s unique contribution to the prediction equation suggested that consistent with the study hypothesis, ERQ reappraisal subscale score and ERQ suppression subscale score were both found to make independent and unique contributions to the model (see Table 8). Participant gender and age group also made independent and unique contributions to the model. ERQ reappraisal subscale score, suppression subscale score, participant gender, and age group accounted for approximately 2%, 1%, 3%, and 8% of the variance in PSWQ-A total score respectively. No other variables were significant.

**Emotion Regulation and Age/Gender Differences**

Prior to completing exploratory testing for age differences in suppression and reappraisal strategies, older and younger adults were compared on demographic variables of interest (i.e., number of months living with pain, whether or not they are currently taking pain medication, participant gender, and relationship status).

Significant differences were found with respect to older and younger adult’s reported number of months living with pain, $t(504) = 8.55, p < 0.001$. Older and younger adult’s relationship status was found to be significantly different, $\chi^2(5, n = 511) = 195.31, p < 0.001$. Significant differences were also found with respect to younger and older adult self-reported medication use (i.e., participants indicated they were currently taking at least one pharmacological product for their chronic pain), $\chi^2(1, n = 511) = 19.24, p < 0.001$. The two groups of participants did not differ with respect to gender. See Table 2
for participant demographic characteristics. Significant variables were considered as covariates in follow-up ANOVAs only if the variable(s) correlated with dependent variables of interest (i.e., ERQ reappraisal and suppression subscale scores).

**Reappraisal and age/gender differences.** A 2 x 2 ANOVA was completed with age (older vs. younger adults) and gender as between subject factors in order to explore whether older and younger adults responded differently on the ERQ reappraisal subscale. Results indicated a significant gender x age group interaction, \( F(1,507) = 11.78, p = 0.001, \eta^2 = 0.0 \). Examination of means revealed that on average, younger adult males (\( M = 30.42; SD = 6.19 \)) scored higher on the ERQ reappraisal subscale than their older adult counterparts (\( M = 28.45; SD = 5.51 \)). Follow-up t-test revealed that this difference was significant, \( t(250) = -2.64, p = 0.009 \). Younger adult females (\( M = 28.91; SD = 6.70 \)) scored lower than their older adult counterparts (\( M = 30.72; SD = 5.84 \)). Follow up t-test determined that this difference was also found to be significant, \( t(257) = 2.24, p = 0.026 \). No other significant results were found.

**Suppression and age/gender differences.** A 2 x 2 analysis of covariance (ANCOVA) was completed with age (older and younger) and gender as between subject factors, while relationship status (correlated significantly with ERQ suppression) was used as covariate in order to explore whether older and younger adults responded differently with respect to the ERQ suppression subscale. There was a main effect for participant gender, \( F(1,506) = 47.08, p < 0.001, \eta^2 = 0.08 \), and relationship status, \( F(1,506) = 4.28, p = 0.039, \eta^2 = 0.008 \). In general, males (\( M = 17.75; SD = 4.55 \)) scored higher than females (\( M = 14.59; SD = 5.27 \)) on the suppression subscale of the ERQ and follow up t-test revealed that this difference was significant, \( t(509) = 7.24, p < 0.001 \).
Exploratory analyses revealed that younger adult males ($M = 18.43; SD = 4.56$) scored higher on the ERQ suppression subscale than their older adult counterparts ($M = 17.09; SD = 4.47$). Follow up t-test revealed that this difference was significant, $t(250) = -2.39, p = 0.018$. Younger adult females ($M = 14.55; SD = 5.40$) scored lower than their older adult counterparts ($M = 14.47; SD = 5.05$); however, t-test analysis showed that this difference was not significant. No other significant results were found.

**Tests of Hypothesized Mediation Effects**

In order to determine if either ER strategy mediated the relationships between 1) SVFPQ-III total scale score and PCS total scale score; 2) SFMPQ affective pain subscale score and PCS total scale score; and 3) SFMPQ sensory pain subscale score and PCS total scale score, mediation analyses consistent with Hayes’ (2013) recommendations were followed. Separate mediation models were tested for each of the two age groups using a Statistical Package for the Social Sciences (SPSS version 19.0) macro (i.e., PROCESS version 2). This macro uses path analyses to estimate direct and indirect effects of a predictor variable on an outcome. Bootstrapped 95% confidence intervals using 5000 samples using (i.e., representing various combinations of participants from the total pool) allow for the estimation of indirect effects of mediators on the outcome variable, where intervals not including zero are considered significant. In contrast to simple ordinary least squares approach to mediation analysis (Baron & Kenny, 1986), this method does not require a significant direct effect of the predictor variable on the outcome variable in order to test for mediation. Hayes’ (2013) macro is further optimal as it maximizes power using smaller sample sizes and does not require data to adhere to assumptions of normality.
Reappraisal as a mediator for older adult pain experiences. Three separate mediation analyses were conducted to examine whether the effect of 1) fear of pain; 2) sensory dimensions of pain intensity; and 3) affective dimensions of pain intensity on pain catastrophizing was mediated by ER reappraisal strategies (see Figure 3). Among older adults, the ERQ reappraisal subscale did not fully mediate any of the hypothesized models; however, partial mediation of a single model was found. The indirect effect of fear of pain on pain catastrophizing was not significant $b=0.00$, 95% CI [-0.02, 0.01], $R^2=0.00$ [-0.01, 0.02]. The direct effect of fear of pain on pain catastrophizing was significant, $b=0.45$, 95% CI [0.35, 0.55]. The indirect effect of sensory dimensions of pain intensity on pain catastrophizing was not significant $b=-0.01$, 95% CI [-0.05, 0.01], $R^2=0.00$ [-0.02, 0.02]. The direct effect of sensory dimensions of pain intensity on pain catastrophizing was significant, $b=0.97$, 95% CI [0.81, 1.12]. The indirect effect of affective dimensions of pain intensity on pain catastrophizing was significant $b=-0.06$, 95% CI [-0.17, -0.01], $R^2=-0.01$ [-0.04, 0.02]. The direct effect of affective dimensions of pain intensity on pain catastrophizing was also found to be significant, $b=2.00$, 95% CI [1.69, 2.31], suggesting partial mediation with respect to the impact ERQ reappraisal strategy had on the relationship between affective dimensions of pain intensity and pain catastrophizing.

Suppression as a mediator for older adult pain experiences. Three separate mediation analyses were conducted to examine whether the effect of 1) fear of pain; 2) sensory dimensions of pain intensity; and 3) affective dimensions of pain intensity on pain catastrophizing was mediated by ER suppression strategies (see Figure 4). ERQ suppression subscale scores did not mediate any of the hypothesized models with respect
Figure 3

*Older Adult Representation of the Relationship between 1) Fear of Pain, 2) Sensory Dimensions of Pain Intensity, 3) Affective Dimensions of Pain Intensity and Pain Catastrophizing Mediated through Emotional Regulation Reappraisal Strategy*

Figure 3. Older Adult Representation of the Relationship between 1) Fear of Pain, 2) Sensory Dimensions of Pain Intensity, 3) Affective Dimensions of Pain Intensity, and Pain Catastrophizing Mediated through Emotional Regulation Reappraisal Strategy. PCS = Pain Catastrophizing Scale (Sullivan et al., 1995); SVFPQ-III = Shortened Version of the Fear of Pain Questionnaire – III (Albaret et al., 2004; McNeil & Rainwater, 1998); SFMPQ = McGill Pain Questionnaire Short Form (Melzack, 1987); ERQ = Emotion Regulation Questionnaire (Gross & John, 2003). *p ≤ 0.05
Figure 4

*Older Adult Representation of the Relationship between 1) Fear of Pain, 2) Sensory Dimensions of Pain Intensity, 3) Affective Dimensions of Pain Intensity and Pain Catastrophizing Mediated through Emotional Regulation Suppression Strategy*

PCS = Pain Catastrophizing Scale (Sullivan et al., 1995); SVFPQ-III = Shortened Version of the Fear of Pain Questionnaire – III (Albaret et al., 2004; McNeil & Rainwater, 1998); SFMPQ = McGill Pain Questionnaire Short Form (Melzack, 1987); ERQ = Emotion Regulation Questionnaire (Gross & John, 2003). * $p \leq 0.05$
to older adults. The indirect effect of fear of pain on pain catastrophizing was not significant, $b=0.01$, 95% CI [-0.02, 0.04], $R^2=0.01$ [-0.02, 0.04]. The direct effect of fear of pain on pain catastrophizing was significant, $b=0.44$, 95% CI [0.35, 0.54]. The indirect effect sensory dimensions of pain intensity on pain catastrophizing was not significant, $b=0.02$, 95% CI [-0.01, 0.07], $R^2=0.02$ [-0.01, 0.06]. The direct effect of sensory dimensions of pain intensity on pain catastrophizing was significant, $b=0.94$, 95% CI [0.79, 1.09]. The indirect effect of affective dimensions of pain intensity on pain catastrophizing was not significant, $b=0.03$, 95% CI [-0.03, 0.14], $R^2=0.01$ [-0.01, 0.06]. The direct effect of affective dimensions of pain intensity on pain catastrophizing was significant, $b=1.90$ 95% CI [1.61, 2.20].

Reappraisal as a mediator for younger adult pain experiences. Three separate mediation analyses were conducted to examine whether the effect of 1) fear of pain; 2) sensory dimensions of pain intensity; and 3) affective dimensions of pain intensity on pain catastrophizing was mediated by ER reappraisal strategies (see Figure 5). With respect to younger adults, ERQ reappraisal subscale did not mediate any of the hypothesized models. The indirect effect of fear of pain on pain catastrophizing was not significant, $b=-0.01$, 95% CI [-0.04, 0.00], $R^2=-0.01$ [-0.03, 0.00]. The direct effect of fear of pain on pain catastrophizing was significant, $b=0.48$, 95% CI [0.37, 0.60]. The indirect effect of sensory dimensions of pain intensity on pain catastrophizing was not significant, $b=0.01$, 95% CI [-0.01, 0.05], $R^2=0.00$ [0.00, 0.04]. The direct effect of sensory dimensions of pain intensity on pain catastrophizing was significant, $b=1.14$, 95% CI [0.95, 1.32]. The indirect effect of affective dimensions of pain intensity on pain catastrophizing was not significant, $b=0.01$, 95% CI [-0.01, 0.10], $R^2=0.01$ [0.00, 0.04].
Younger Adult Representation of the Relationship between 1) Fear of Pain, 2) Sensory Dimensions of Pain Intensity, 3) Affective Dimensions of Pain Intensity, and Pain Catastrophizing Mediated through Emotional Regulation Reappraisal Strategy

Figure 5. Younger Adult Representation of the Relationship between 1) Fear of Pain, 2) Sensory Dimensions of Pain Intensity, 3) Affective Dimensions of Pain Intensity, and Pain Catastrophizing Mediated through Emotional Regulation Reappraisal Strategy. PCS = Pain Catastrophizing Scale (Sullivan et al., 1995); SVFPQ-III = Shortened Version of the Fear of Pain Questionnaire – III (Albaret et al., 2004; McNeil & Rainwater, 1998); SFMPQ = McGill Pain Questionnaire Short Form (Melzack, 1987); ERQ = Emotion Regulation Questionnaire (Gross & John, 2003). * $p \leq 0.05$
The direct effect of affective dimensions of pain intensity on pain catastrophizing was significant, $b=2.32$, 95% CI [1.97, 2.66].

**Suppression as a mediator for younger adult pain experiences.** Three separate mediation analyses were conducted to examine whether the effect of 1) fear of pain; 2) sensory dimensions of pain intensity; and 3) affective dimensions of pain intensity on pain catastrophizing was mediated by ER suppression strategies (see Figure 6). ERQ suppression subscale scores did not mediate any of the hypothesized models with respect to younger adults. The indirect effect of fear of pain on pain catastrophizing was not significant, $b=0.00$, 95% CI [-0.01, 0.03], $R^2=0.00$ [0.00, 0.03]. The direct effect of fear of pain on pain catastrophizing was significant, $b=0.47$, 95% CI [0.35, 0.59]. The indirect effect of sensory dimensions of pain intensity on pain catastrophizing was not significant, $b=0.01$, 95% CI [-0.01, 0.05], $R^2=0.01$ [0.00, 0.04]. The direct effect of sensory dimensions of pain intensity on pain catastrophizing was significant, $b=1.14$, 95% CI [0.95, 1.32]. The indirect effect of affective dimensions of pain intensity on pain catastrophizing was not significant, $b=0.01$, 95% CI [-0.01, 0.10], $R^2=0.01$ [0.00, 0.04]. The direct effect of affective dimensions of pain intensity on pain catastrophizing was significant, $b=2.32$, 95% CI [1.98, 2.66]. Table 9 provides a summary of all mediation models tested.
Younger Adult Representation of the Relationship between 1) Fear of Pain, 2) Sensory Dimensions of Pain Intensity, 3) Affective Dimensions of Pain Intensity, and Pain Catastrophizing Mediated through Emotional Regulation Suppression Strategy

Figure 6. Younger Adult Representation of the Relationship between 1) Fear of Pain, 2) Sensory Dimensions of Pain Intensity, 3) Affective Dimensions of Pain Intensity, and Pain Catastrophizing and Mediated through Emotional Regulation Suppression Strategy. PCS = Pain Catastrophizing Scale (Sullivan et al., 1995); SVFPQ-III = Shortened Version of the Fear of Pain Questionnaire – III (Albaret et al., 2004; McNeil & Rainwater, 1998); SFMPQ = McGill Pain Questionnaire Short Form (Melzack, 1987); ERQ = Emotion Regulation Questionnaire (Gross & John, 2003). * p ≤ 0.05
Table 9

Summary of All Mediation Model Results Tested For Older and Younger Adults

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Table 9 Continued

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Discussion

The main contributions of this research study include the validation of a widely used measure of ER with older adult populations as well as the reaffirmation of the positive predictive relationships between ER suppression strategy, worry, and depression. Moreover, the negative association between ER reappraisal strategy, worry, and depression was also established. Despite these findings, there was no evidence that suppression and reappraisal play a mediating role between pain intensity or fear of pain and pain catastrophizing in older or younger adult chronic pain populations. While the findings with regards to reappraisal and suppression are consistent with previous investigations of chronic pain (e.g., van Middendorp et al., 2008; Wong & Fielding, 2013) this study was the first to explore the relationship between ER and chronic pain in older adult populations.

According to a widely held belief, reappraisal of negative emotions and cognitions is more advantageous than suppression of those very same experiences (Gross & John, 2003). Beyond showing pain catastrophizing as a mediator between pain and negative emotions (e.g., Sullivan, Rodgers et al., 2001), no clear link has been established demonstrating the impact of reappraisal or suppression on relationships between dimensions of chronic pain in older adults. To date, only one investigation of ER and pain in older populations has taken place (Paquet et al., 2005). Paquet and colleagues (2005) examined the relationship between non-specific ER and acute pain in older adults. This study is the first to investigate the relationship between specific ER strategies (suppression and reappraisal) and sensory as well as affective dimensions of pain intensity in older adults living with chronic pain. The same holds true for both fear of
pain and catastrophizing in order adult populations. Exploration of this relationship can have implications for the fear-avoidance model of pain (e.g., Vlaeyen & Linton, 2000; Asmundson et al., 2012; Crombez et al., 2012) as well as the treatment of pain-related emotional distress (e.g., Paquet et al., 2005).

**Validity of the Emotion Regulation Questionnaire**

An initial goal of Study 1 was to validate Gross and John’s (2003) widely used measure of emotion regulation, the ERQ, for use with older adults. This validation was important to conduct because previous research assessing ER strategies with older adults had several limitations (e.g., de Frias, 2014; Paquet et al., 2005). Therefore, evidence validating an established measure of ER for use with community-based older adults is essential in order to facilitate much needed future investigation. Results from this study supported the internal consistency and validity of the ERQ (Gross & John, 2003) for use with individuals aged 65 years or older residing within the community. Specifically, the suppression and reappraisal subscales of the ERQ did not correlate strongly with a measure of depression (CES-D: Radloff, 1977) and worry (PSWQ-A: Hopko et al., 2003) (Gross & John, 2003) consistent with expectations for discriminant validity. The ERQ is not a measure of specific emotions and symptomology, unlike the PSWQ-A and the CES-D but rather a measure of strategies (i.e., reappraisal, suppression) commonly used by individuals to help regulate emotional experiences and expression (Gross & John, 2003). In contrast, the ERQ was substantially correlated with the ASQ (Hoffmann & Kashdan, 2010) confirming its convergent validity of the two similar measures. As hypothesized, for older adults the ASQ concealment subscale correlated strongly and significantly with the ERQ suppression subscale, while the ASQ adjustment subscale correlated moderately
albeit significantly with the ERQ reappraisal subscale. Results from this study are consistent with previous findings involving undergraduate student populations (Hofmann & Kashdan, 2010).

Approximately twice as many participants were recruited online as compared to traditional methods of local recruitment, further suggesting that online recruitment strategies were far more effective than traditional less cost and time-effective methods. Comparisons made between online responses and the paper and pencil hardcopy responses revealed that consistent with past research (e.g., Gosling et al., 2004), the two groups in the present study did not differ significantly across the two response protocols, allowing for the collapsing of the data to form a unified data set. While the sample size for this study was similar to de Frias’ (2014) study size, the age range was not since de Frias (2014) included individuals as young as 51 years whereas 65 years was the minimum age that was considered in this investigation. In this study, the internal consistency of both the suppression and reappraisal subscales with a true older adult community dwelling population (65+ years of age) was satisfactory and consistent with de Frias’ (2014) findings.

The overall aim of Study 2 was to investigate whether specific ER strategies (i.e., suppression and reappraisal), mediated the relationship between pain intensity and fear of pain, with pain catastrophizing across gender and age group (older and younger adults). Following the validation of the ERQ for use with older adults, Qualtrics research panels used in Study 2 allowed for the collection of data from a larger sample size than would typically be possible through local recruitment. Using Qualtrics research panels permitted the establishment of sufficient power for all statistical analyses completed as
part of Study 2. Previously, researchers quantified and qualified ER as being any variation of self-reported emotion(s) within a specific period of time (e.g., Agar-Wilson & Jackson, 2012; Connelly et al., 2007; Paquet et al., 2005). By simply defining ER as change from one emotional state to another limited researchers’ ability to determine if maladaptive (e.g., suppression) or adaptive (e.g., reappraisal) ER coping strategies are being specifically employed and the effects they had if any, on changes in emotional states. Prior to this study, only one previous investigation involved the use of the ERQ (de Frias, 2014) with an identified older adult populations. Even so, a limitation of de Frias’ (2014) investigation was that the sample was restricted to healthy individuals without cognitive challenges and impairment. Older adults commonly experience mental health concerns such as stroke and dementia (Lo Coco et al., 2016) which limits the generalizability of de Frias’ (2014) findings. Moreover, as part of her investigation de Frias (2014) collected data from adults aging in range from 51 to 85. A large number of participants between the ages of 51 to 65 years are in the pre-retirement phase of life. Thus, their results may not be generalizable to samples that are older than 65 and more likely to have retired from the work force (Abeles et al., 1998). As such, the validation of the ERQ, demonstrated through the findings of the present study, was important to undertake.

Prediction of Pain Catastrophizing

Investigation of Study 2, Hypothesis 1, demonstrated that consistent with biopsychosocial models of pain (Hadjistavropoulos et al., 2011), gender, self-reported depression, worry, pain intensity, pain duration, and fear of pain were all significantly associated with pain catastrophizing. This finding is consistent with previous research
Findings from this study expand upon previous knowledge given that this was the first investigation to include a true older adult sample. Previous investigations such as those conducted by Keefe and colleagues (2000) and Sullivan and colleagues (1995) were not exclusively limited to older adult populations leaving questions about the generalizability of the findings to this age group. In contrast, Ruscheweyh and colleagues (2011) did compare older adults to younger adults with regards pain catastrophizing; however, in doing so they loosely defined older adults as ranging in age 50-70 years of age which represents a considerably lower age limit than was adopted in this investigation (Ruscheweyh et al., 2011). As expected, age did not predict pain catastrophizing in keeping with results from previous research (Keefe & Williams, 1990; Turner, Mancl, & Aaron, 2004; Ruscheweyh et al., 2011).

Positive predictors of pain catastrophizing. The mediating effects of ER strategy on the relationship between pain intensity and fear of pain with pain catastrophizing was examined. Dispositional pain catastrophizing is (retrospectively) recalled by an individual and is not controlled or manipulated through laboratory intervention or experimentation (e.g., Campbell et al., 2010). In this present study, this form of pain catastrophizing was measured through participant self-report. Results in the present study are consistent with past findings, suggesting a predictive link between non-pain specific variables (i.e., participant gender, depression, worry) and pain catastrophizing. As expected, pain specific factors (i.e., pain intensity, pain duration, and fear of pain) also demonstrated a predictive relationship to catastrophizing. Establishing these predictive relationships in this study allows for the possibility that a mediating
factor(s), including the potential for an ER strategy such as suppression or reappraisal to contribute to the overall models tested in Hypothesis 3.

**Age and pain catastrophizing.** Age has consistently been shown to be unrelated to dispositional catastrophizing (e.g., Keefe & Williams, 1990; Turner, Mancl, & Aaron, 2004; Ruscheweyh et al., 2011). Findings from this present study remained consistent with previous results. Even so, Ruscheweyh and colleagues (2011) found that pain catastrophizing measured during or directly following noxious stimulation (e.g., Campbell et al., 2010; Ruscheweyh et al., 2011) was associated with emotional responses to pain, whereas in older adults it was associated with pain intensity. One potential explanation for Ruscheweyh and colleagues (2011) findings is the possible existence of an indirect relationship between pain catastrophizing and age in which catastrophizing is determined by personality traits in young adults and is continuously influenced by the individual’s pain experience across their life span (Dixon, Thorn, & Ward, 2004). Specifically, Dixon and colleagues (2004) provide evidence for an indirect mediation model similar to those proposed in Hypothesis 3 of this study; that could potentially explain the age-related differences Ruscheweyh and colleagues (2011) found. This study did not support the extension of these models with regards to dispositional pain catastrophizing.

**Emotion Regulation and Other Predictors of Pain-Related Outcomes**

ER reappraisal strategy as measured by the ERQ (Gross & John, 2003) did not predict any of the pain specific outcomes as measured by the SVFPQ-III (Albaret et al., 2004; McNeil & Rainwater, 1998), PCS (Sullivan et al., 1995), or SFMPQ (Melzack, 1987). This finding was inconsistent with Hypothesis 2 (i.e., reappraisal will be
negatively associated with fear of pain, pain catastrophizing, pain intensity, depression, and worry while suppression will be positively associated with the aforementioned). Although ER suppression strategy did not significantly predict fear of pain (FPQ), it was positively predictive of pain intensity (SFMPQ), and pain catastrophizing (PCS), consistent with Hypothesis 2.

Partial support for Hypothesis 2 was found through the suppression strategy results. The same did not hold true for the reappraisal strategy, and the expected inverse relationship with negative pain outcomes was not supported. Moreover, few investigations to date support the role of reappraisal strategy in reducing pain and pain-related factors (Gilliam et al., 2010; Hamilton, Zautra, & Reich, 2007; Ruiz-Aranda et al., 2010). Albeit, two of these studies (Gilliam et al., 2010; Ruiz-Aranda et al., 2010) involved the investigation of acute pain only while the third (Hamilton et al., 2007) was limited to older adult females with arthritis. A fourth investigation led to the conclusion that both experimentally-induced ER suppression and reappraisal were effective strategies in reducing perceived pain intensity, pain unpleasantness, anxiety, and tension as compared to a control condition (Hampton et al., 2015). Despite these findings, Hampton and colleagues (2015) concluded that both ER strategies were unrelated to pain threshold and tolerance (Hampton et al., 2015). Yet in order for Hypothesis 2 to hold true, both reappraisal and suppression would need to act in an opposite manner with regards to pain-related constructs. Specifically, the absence of fear of pain, pain catastrophizing, and perceived pain intensity is due to ER reappraisal, while the presence of these pain-related experiences is attributed to increased suppression strategy use. Limited evidence for this inverse relationship exists in the pain literature which ignores
the potential role for reappraisal strategy and largely supports the relationship between increased suppression and negative pain outcomes (e.g., Quartana & Burns, 2007; Quartana, Yoon, & Burns, 2007; Quartana, Bounds, Yoon, Goodin, & Burns, 2010).

Even so, ER strategies are widely recognized to be on a continuum (Gross, 1998a). An individual can reasonably expect to implement one or more ER strategy at any given time. This choice of ER strategy implementation can be in response to a specific trigger and/or based on biopsychosocial factors. Moreover, the presence or absence of a single ER strategy has less influence on the mechanism by which other ER strategies are consciously or unconsciously implemented (see Gross 1998a for a complete review).

Furthermore, with regards to experimental manipulation of the pain experience, Hampton and colleagues (2015) concluded that individuals have the capacity to adjust their ER strategy use given that no differences were found between suppression and reappraisal with regards to their effects on the pain experience.

Despite the ability of an individual to effectively implement a variety of ER strategies (e.g., Gross 1998a; Hampton et al., 2015), findings from this study as well as previous research on acute pain (e.g., Cioffi & Holloway, 1993; Gilliam et al., 2010; Sullivan et al., 1997) lend support to the notion that within chronic pain populations, focus of intervention should be directed towards reducing pain intensity and psychological reactivity (i.e., catastrophizing response) through the development of skills aimed at managing and potentially minimizing suppression strategy use rather than focusing on improving ER reappraisal strategies. In this study suppression was positively related to catastrophizing and pain intensity in our chronic pain population, while reappraisal was not. Moreover, people who catastrophize and simultaneously attempt to
use maladaptive ER strategies (i.e., suppression) are susceptible to prolonged recovery and added discomfort (Gilliam et al., 2010). Further support for this idea can be garnered from Wong and Fielding (2013) who determined that the significant association between reappraisal and pain catastrophizing did not hold after controlling for demographic and pain variables; whereas suppression continued to mediate the relationship between negative affect and pain catastrophizing suggesting a link between suppression and catastrophizing. In addition, Sullivan and colleagues (1997) found that participants who were asked to suppress reported higher pain intensity than their nonsuppressing counterparts.

**Emotion regulation as a predictor of mood and anxiety.** Emotion regulation reappraisal and suppression were significant predictors of depression (CES-D: Radloff, 1977) and worry (PSWQ-A: Hopko et al., 2003) in both our older and younger chronic pain participants. In addition, suppression was positively associated with both depression and worry while as hypothesized, reappraisal was negatively associated with the aforementioned psychological constructs. This suggests that engaging in suppression strategy will result in increased anxiety and depressed mood, while the opposite is true for the more adaptive reappraisal strategy. The present findings have implications for the fear-avoidance model of pain given that the theorists behind this model posit that pain catastrophizing is exacerbated by negative affective experience (Vlaeyen & Linton, 2000/2012). As such, pain catastrophizing can be proactively managed through management of negative affectivity which in turn is positively influenced by suppression and inversely related to reappraisal. In terms of clinical implications, support for disrupting the negative cycle of fear-avoidance behaviours in chronic pain patients can be
gleaned from recent investigations of Emotion Regulation Therapy which has been found to be an effective strategy for managing negative distress and behaviours such as avoidance, rumination, worry, and low mood (Mennin, Fresco, Ritter, & Heimberg, 2015; Renna, Quintero, Fresco, & Mennin, 2017). While emotional reactivity to a painful experience is expected (Melzack & Wall, 1965) and consistent with the findings of this study, it may only adversely influence the chronic pain experience when one attempts to suppress it (e.g., Burns et al., 2010; Quartana et al., 2010; Sullivan et al., 1997). This initial suppression of negative emotions likely perpetuates emotional reactivity which then further maintains the catastrophizing response to pain, consistent with the cyclical nature of the fear-avoidance model. This study lends support to the possibility of disrupting the cycle of fear-avoidance in chronic pain populations by challenging direct components of the model (i.e., catastrophizing, pain-related fear, and negative affectivity) through ER training. More specifically, suppression management may prove to be an effective and less intense intervention for chronic pain patients who are often older and more likely to engage in stoicism and suppression of their experience (e.g., Jones et al., 2005). Emotion regulation-based interventions for addressing fear-avoidance behaviours in clinical chronic pain populations warrants further investigation. Repeated demonstration of the effectiveness of ER training for chronic pain could lend further support to the disruptive role of suppression in exacerbating negative emotional experiences during the chronic pain experience. Previous research findings appear to reinforce the potential value of suppression management for patients experiencing pain since individuals who relied on suppression are more likely to experience negative emotions (Gross & John, 2003) and increased pain and pain-related distress (Burns et al.,
Influence of emotion regulation on gender and pain-related factors. In this study gender predicted fear of pain when regression models included ER independent variables (i.e., suppression and reappraisal). When collapsed across age, females obtained higher average scores than their male counterparts on the SVFPQ-III. Gender differences with regards to fear of pain found as part of this study hold important implications for the generalizability of any findings from this study to chronic pain populations and is also in keeping with previous investigations (see Bartley & Fillingim, 2013; Greenspan et al., 2007; Mogil & Bailey, 2010 for further discussion). To date, investigations of fear of pain are limited to younger populations experiencing acute challenges (e.g., Heft, Meng, Bradley, & Lang, 2007; Horn, Alappattu, Gay, & Bishop, 2014; Vambheim & Øie, 2017) while attention is directed to fear-avoidance beliefs in older populations living with chronic pain (e.g., Camacho-Soto et al., 2012; Kovacs et al., 2008). Despite this, regardless of age and pain, women are generally considered to be more fearful than men (McLean & Anderson, 2009) and increased fear of pain in females (e.g., Heft et al., 2007; Vambheim & Øie, 2017) is believed to be mediated through neuroticism (e.g., Courbalay, Deroche, & Woodman, 2016; Goubert, Crombez, & Van 2010; Cioffi & Holloway, 1993; Elfant et al., 2008; Gilliam et al., 2010; Quartana et al., 2010; Sullivan et al., 1997). Difficulties with ER contribute to distress associated with chronic pain (Koechlin, et al., in press; Le Borgne et al., 2017). Preliminarily investigations of interventions that included an ER training component for chronic pain in adult populations have revealed promising outcomes (Gottschalk, Bleichhardt, Kleinstäuber, Berking, & Rief, 2015; Kleinstäuber; Gottschalk, Berking, Rau, & Rief, 2016).
Damme, 2004; Lahey, 2009). Vambheim and Øie (2017) propose the development of interventions tailored uniquely for men and women with a larger emphasis on evaluating emotional interpretations and reactivity to pain in women. Such interventions would likely benefit from addressing the relationship between higher fear of pain and lower pain tolerance that has been observed in females (Thibodeau, Welch, Katz, & Asmundson, 2013). While suppression did not predict fear of pain in this study, reduced pain tolerance is linked to suppression of negative emotions such as anger (Burns et al., 2007; Quartana et al., 2007). Further research into the relationship among emotions, suppression and the pain tolerance is needed.

**Impact of emotion regulation on pain duration and pain-related outcomes.**

Number of months living with pain predicted depression and further made a unique contribution over and above ER variables (i.e., suppression and reappraisal). This is not unexpected given the relationship between chronic pain and depression is well established (Wang, Hah, & Carroll, 2009) with as many as 65% of chronic pain sufferers’ concurrently experiencing symptoms of depression (Katona et al., 2005). In general, an increase in pain is directly tied to greater severity of depressive symptoms endured (e.g., Triverdi, 2004) and this pain-depression link can be partly explained by their hypothesized shared neurological pathway (Basbaum & Fields, 1978). As such, Triverdi (2004) posits that treating both depression and chronic pain together will more likely allow for remission of physical and emotional symptoms in clinical populations. Further clinical research into the utility of Emotion Regulation Therapy (e.g., Mennin, Fresco, Ritter, & Heimberg, 2015; Renna, Quintero, Fresco, & Mennin, 2017) as a transdiagnostic approach for pain and depression is likely needed given the negative
impact of poor ER (e.g., suppression) on the exacerbation of the overall pain experience (e.g., Burns et al., 2010; Quartana et al., 2010; Sullivan et al., 1997).

**Influence of emotion regulation on age as a predictor of pain-related outcomes.** Age group (younger versus older) was the only variable that positively and significantly predicted every outcome of interest (i.e., depression, worry, fear of pain, pain catastrophizing, and pain intensity). In this current study, older adults were more likely to report fewer mood, anxiety (i.e., depression, worry), and pain concerns (i.e., pain catastrophizing, fear of pain, pain intensity) than their younger counterparts. Older adults underreporting of psychological aspects of pain may be owing to their stoicism (e.g., Cook & Chastain, 2001; Jones et al., 2005). Specifically, older adults living with chronic pain may be less likely to disclose their discomfort than their younger counterparts for a variety of psychosocial reasons (see Martin et al., 2005 for a qualitative review of challenges working with older adult chronic pain populations). The age differences found in this study are not consistent with previous investigations. Cook and colleagues (2006) note that in pain populations, both fear and catastrophizing are generally assumed to be higher for older adults. In contrast to this assumption, they determined that older adult pain patients had lower pain-related fear relative to middle-aged patients who visited pain clinics. However, older adults may centre their catastrophizing behaviour differently than their younger adult counterparts (Cook et al., 2006).

In this study, age did not predict pain catastrophizing when the regression model did not include ER strategies as independent variables. Age accounted for approximately a tenth of a percent of variance in catastrophizing when rounded. However, the inclusion of suppression and reappraisal within the model increased the explained variance by
nearly 60 times. Previous investigations do not support a role for age as a predictor of
catastrophizing (Keefe & Williams, 1990; Turner, Mancl, & Aaron, 2004; Ruscheweyh et
al., 2011) and this finding was replicated in this study in the absence of ER within the
overall model. The subsequent large increase in variance explained by age can likely be
attributed to a bias known as statistical confounding (see Skelly, Dettori, & Brodt, 2012
for a brief review). The relationship between age and pain catastrophizing is likely being
confounded by either one or both ER suppression and reappraisal variables. The
confounding effect falsely demonstrates an apparent association between age and pain
catastrophizing that does not otherwise hold true (Skelly et al., 2012). Moreover, since
age, a continuous variable is dichotomized (age group) in this study as older and younger
adult with arbitrary cut-offs (i.e., 35 years and younger, 65 years and older), it is more
likely susceptible to confounding (Skelly et al., 2012). The confounding effect of ER on
age and its impact on pain catastrophizing lend support to the need for additional
investigation of age differences that might exist between ER strategy and pain
catastrophizing, which were evaluated in this study. Even so, future investigations may
benefit from replicating models presented in this study with the inclusion of age as a
continuous rather than a dichotomous variable in order to better control for potential
confounding effects of either or both ER strategy.

Emotion Regulation Age and Gender Differences in Chronic Pain Populations

One of the goals of this study was to investigate and replicate suppression and
reappraisal age and gender differences using the ERQ (e.g., Gross & John, 2003;
Masumoto et al., 2016) consistent with the socioemotional selectivity theory (Charles &
Carstensen, 2007). Specifically, older adults would demonstrate more reappraisal use
and less suppression strategy use as compared to their younger counterparts (Charles & Carstensen, 2007). Both older and younger adults recruited in the present study responded inconsistently with other non-chronic pain populations (e.g., John & Gross, 2004; Masumoto et al., 2016; Nolen-Hoeksema & Aldao, 2011). Specifically, in this present study, younger adult males reported engaging in more suppression as compared to older adult males; however, no differences were observed when comparing younger adult females and their older counterparts. When considering suppression strategies, a main effect for gender was found with males reporting a higher suppression scores than females overall consistent with previous investigations (e.g., Balzarotti et al., 2010; Barrett & Bliss-Moreau, 2009; Gross & John, 2003; Melka et al., 2011; Spaapen et al., 2014; Wiltink et al., 2011).

Similarly, to suppression, younger adult males were more likely to engage in reappraisal strategies as compared to older adult males. This was not true of younger adult females who reported reduced likelihood of engaging in reappraisal as compared to their older female counterparts. In contrast to suppression, reappraisal strategy use yielded no main effect for gender or age.

In this study, it is not clear why younger adult males and older adult females with chronic pain engage in more reappraisal strategies than their respective counterparts; however, Molton and colleagues (2008) suggest that coping strategies and differences across age groups should be anticipated given the broad array of strategies that can be classified as pain coping. For example, Molton and colleagues (2008) found that as adults aged, they developed more effective emotion and non-emotion based coping techniques to manage chronic pain while LaChapelle and Hadjistavropoulos (2005) found
the opposite to be true. Barrett and Bliss-Moreau (2009) suggested that females are more inclined to experience intense emotions whereas males were viewed as avoiders of emotion. Even so, the degree of stoicism and emotion avoidance is likely not static across both genders since for example, older adult males with chronic pain are more stoic than their younger male counterparts (e.g., Abdulla et al., 2013; Cornally & McCarthy, 2011). Stoic older adults tend to report less affective distress in relation to their pain levels (e.g., Cook & Chastain, 2001).

The influence of stoicism may suggest that, as males age they tend to avoid emotion-based coping strategies in preference for alternative options such as task persistence and physical strategies while older females are more likely experience emotions and continue engaging in affective coping such as ER. Findings from this study would support this hypothesis and are consistent with Nolen-Hoeksema and Aldao (2011), Tamres and colleagues (2002) and Spaapen and colleagues (2014) who found that women were more likely than men to report using reappraisal strategies. Others have found no gender differences with regards to reappraisal strategy use (e.g., Gross & John, 2003). A number of recent investigations point to the influence pain beliefs have with respect to coping and recovery outcomes (e.g., Ghandehari et al., 2013; Jensen et al., 2017; Miró, Solé, Gertz, Jensen, & Engel, 2017; Ziadni, Sturgeon, & Darnall, in press). Moreover, findings highlight the impact emotional beliefs about the pain experience have on functioning and recovery (e.g., Miró et al., 2017). Adaptive and maladaptive beliefs (e.g., controllability versus uncontrollability) about emotions directly influence the motivation to engage in ER (Ford & Gross, 2018; Howell, Passmore, & Holder, 2016) which may explain why older adult males who are typically viewed as stoic avoiders of
emotions (e.g., Barrett & Bliss-Moreau 2009) choose to engage in less reappraisal strategies as compared to their female counterparts in this study.

In this study participant gender interacted with age. Older adult males reported less reappraisal strategy use than their younger male counterparts, and this was consistent with previous findings in which reappraisal use decreased with age (Nolen-Hoeksema & Aldao, 2011). However, caution is warranted given that others have demonstrated that in males only, reappraisal strategy use increases with age (Masumoto et al., 2016). In contrast, older adult females in this study reported more reappraisal strategy use than their younger female and this was consistent previous investigations by John and Gross (2004) who found similar differences between older and younger adult women. Despite these differences, Spaapen and colleagues (2014) concluded that age did not influence use of either reappraisal or suppression strategy. Further investigation with regards to ER, aging, and chronic pain would likely be beneficial since contrary to this study and previous investigations (e.g., John & Gross, 2004; Nolen-Hoeksema & Aldao, 2011; Tamres, Janicki, & Helgeson, 2002) others have pointed to the consistency of ER strategy use throughout the aging process (e.g., Kunzman et al., 2005). It is possible that methodological and sample differences account for the discrepancy across studies. For example, Gross and John (2003) based their conclusions on a university student recruitment only while Nolen-Hoeksema and Aldao (2011) collected data through random telephone calls. Other investigators limited their recruitment to specific ethnic groups using translation of the original ERQ (e.g., Balzarotti et al., 2010; Masumoto et al., 2016; Wiltink et al., 2011) further limiting the generalizability of their findings with respect to the original ERQ (Gross & John, 2003). These methodological differences
may be in part owing to the varied conceptualizations of ER (i.e., Ford & Gross) that continue to hamper this area of research particularly with regards to chronic pain investigations (Koechlin et al., in press).

**Mediating Effects of ER Strategy on the Pain Experience**

In this study, neither ER strategy was found to be a full mediator in any of the 12 hypothesized models (split by age group). A single model yielded an ordinary least squares partial mediation as described by Baron and Kenny (1986). Specifically, the relationship between affective dimensions of pain intensity (SFMPQ affective subscale) and PCS was partially and negatively mediated by reappraisal in older adults with chronic pain contrary to expectation. Thus, reappraisal has a partial suppressing effect on the relationship between affective dimensions of pain intensity and pain catastrophizing. Put another way, the magnitude of relationship between the two variables increases once reappraisal is introduced into the model (MacKinnon, Krull, & Lockwood, 2000). It is likely that engaging in reappraisal strategy involves cognitive awareness and challenging (Gross & John, 2003) with respect to the affective pain experience and subsequent catastrophizing behaviour. While older adults with chronic are generally more stoic than their younger counterparts (Abdulla et al., 2013; Cornally & McCarthy, 2011), reappraisal strategy use is unlikely to improve their willingness to report on their pain experience (Cook & Chastain, 2001) but may engage their awareness and ability to access a range of coping strategies during distress (Molton et al., 2008).

Eleven other models yielded no differences between the younger and older adults living with chronic pain. In addition, no evidence was found to support the negative mediating influence of ER suppression strategy (Cioffi & Holloway, 1993; Sullivan et al.,
1997) nor the positive mediating influence of ER reappraisal strategy (Gilliam et al., 2010; Hamilton et al., 2007; Ruiz-Aranda et al., 2010). Hampton and colleagues (2015) found no relationship between suppression or reappraisal and pain threshold and tolerance. Results from this study add to these findings by lending support to the notion that neither strategy is more likely to positively or negatively impact the relationship between fear of pain or pain intensity and pain catastrophizing consistent with previous investigations involving chronic pain populations (e.g., Agar-Wilson & Jackson, 2012; Hamilton et al., 2012; van Middendorp et al., 2008; Wong & Fielding, 2013). It is likely that some other factor(s) or combinations of factors are better able to account for the relationship among fear of pain, pain intensity, and pain catastrophizing. These factors may include participant demographics not assessed in this study (e.g., cultural factors), psychosocial variables, as well as genetic susceptibility and neurophysiological correlates (Leung, 2012).

Ruscheweyh and colleagues (2011) concluded that in older adults, pain catastrophizing was not related to emotional aspects of pain but rather to perceived pain intensity. However, a more likely explanation for the partial mediation finding lies with previous research by Molton and colleagues (2008) who suggested that, as individuals age, they develop more adaptive pain coping strategies. Furthermore, Ong and colleagues (2010) determined that highly psychologically resilient participants such as older adults, also rebounded from daily pain catastrophizing by engaging more readily in the experience of positive emotions. Thus, it is not surprising that reappraisal strategy which is generally considered an adaptive emotion-based coping strategy would negatively mediate the relationship between affective dimensions of pain intensity and
pain catastrophizing in older adults living with chronic pain. This is consistent with Ong and colleagues (2010) as well as the belief that older adults are more psychologically resilient (Gooding, Hurst, Johnson, & Tarrier, 2012).

**Study Limitations**

This study incorporated a cross-sectional data collection methodology instead of a longitudinal design. As such, temporal relationships between variables of interest cannot be determined with certainty (Carlson & Morrison, 2009). Cause and effect relationships are not so readily evident in cross-sectional study designs, further making it difficult to explain specific findings (Mann, 2003).

Second, this research involved self-report questionnaires. Self-report data collection methodology may be susceptible to biases such as social desirability (Paulhus & Vazire, 2007). However, such biases are minimized when respondents remain anonymous as is the case in this study (Paulhus & Vazire, 2007). Even so, a limitation of self-report, particularly with regards to online participation in this study involved obtaining supplemental pain medication management information. It is likely that the significant difference found in terms of pain medication usage in Study 1 is owing to follow-up questioning and interviewing that was undertaken once paper hardcopy questionnaires were reviewed with the participant either during completion or later through follow-up contact. More specifically, while many participants endorsed using pharmacological interventions for their pain, upon review many of these medications were deemed to be non-prescription-based supplements or aids that are not unique to pain management (i.e., multivitamins). Unfortunately, reviewing of questionnaire data was not possible during online administration of measures as part of Study 1 or Study 2, and
as such, some participants either endorsed using pharmacological interventions for chronic pain without providing additional details (i.e., name of medication, dosage) and/or provided inaccurate supplemental details (e.g., listing a medication not typically prescribed for pain management). Further evidence for the inaccuracy of this data could be gleaned from study 1, since use of medication for pain (acute and chronic) was the only statistical significant difference found between the two sampling methods (online and paper/pencil hardcopy).

Several specific Study 2 limitations exist. First, as part of this study, participants living with chronic pain (e.g., persistent and reoccurring pain existing for 3 or more months) were recruited independent of pain location or type of pain experienced (e.g., headache pain versus arthritis pain). For example, it is well documented that younger adults are more likely to suffer from pain as a result of injury or accident, whereas older adults are likely to suffer from pain-related diseases such as osteoarthritis (e.g., Rustøen et al., 2005). Not only could such differences impact the type of coping strategy an individual might rely on (e.g., Cano, Mayo, Ventimiglia, 2006; Rustøen et al., 2005) but it may also have a direct effect on the baseline psychosocial wellbeing an individual maintained prior to participating in this study. Rustøen and colleagues (2005) determined that participants in an older age group reported longer pain durations and more comorbidities all the while receiving more pain interventions. Despite these findings, older adults had higher total quality of life scores and reported better mood. Similar findings were replicated in this present study. Specifically, older adults reported better mood and lower overall anxiety (i.e., worry) as compared to younger adults, despite living longer with chronic pain. Even so, not directly accounting for the type of chronic
pain being experienced may have played a confounding role with regards to the type of
ER strategy relied upon or not relied upon by both older and younger adult participants.
Finally, the online recruitment of the sample is a limitation of this study as several types
of participants (e.g., those without internet access and those with visual limitations)
would not have been reached through this recruitment approach.

In this study ER was evaluated from a trait perspective using a retrospective
approach to data collection (i.e., historical self-report). Future research involving older
adults could benefit from assessing whether the type of pain experienced influences ER
strategy choice. Manipulations of pain in older adults through a laboratory research
design (e.g., Hampton et al., 2015) while simultaneously using a “think aloud” procedure
could help facilitate in vivo exploration of ER implementation during a pain episode.
Think aloud procedures require research participants to actively verbalize cognitions and
thought processes while simultaneously completing a task or experiencing an event.
(Ericsson & Simon, 1980). This strategy has successfully been implemented in previous
research involving evaluations of coping strategies (e.g., Whitehead et al., 2018).

Finally, there are some limitations to generalizability of the findings. Some of
these limitations are related to the online recruitment approach (see above) while others
may be related to factors such as cohort effects. In other words, for example, the findings
may not necessarily be generalizable to older adults of future generations.

**Future Directions**

In the future, attempts to study the psychometric properties of the ERQ with
larger older adult populations should involve use of item response theory (Kline, 2005).
Item response theory would provide a more robust and flexible analysis of the measure,
particularly if multiple samples and test forms are used, as was the case in this study (Samejima, 1969). Moreover, item response theory allows for the examination of the properties of each questionnaire item independent of the other items. The item discrimination parameter of item response theory analysis provides a method by which researchers can determine how well items identify participants at different levels of the latent trait (Yang & Kao, 2014).

Replication of this study using age as a continuous variable, specifying the type of chronic pain experienced by individual participants, and exploring unique variants and examples of catastrophizing as related to the pain experience, may also be useful to pursue. It would be interesting to see if the lack of ER mediating capacity is replicated when age is considered as a continuous variable since dichotomization into older and younger age categories likely influences the relationship strength between variables of interest (MaCallum, Zhang, Preacher, & Rucker, 2002). Moreover, by including age as a continuous variable, the likelihood of introducing ER confounding effects with regards to hypothesized relationships involving age and pain catastrophizing can be more effectively managed (Skelly et al., 2012).

Exploring specific chronic pain diagnoses (e.g., arthritis) or localized pain sites (e.g., dental pain) and associated catastrophizing behaviour may also prove advantageous. Differences in pain experience across the lifespan are well documented (e.g., Rustøen et al., 2005) and these differences may impact an individual’s preference for one pain-related coping strategy over another (e.g., Cano et al., 2006; Rustøen et al., 2005). Evidence from this study and previous research exists to suggest that older and younger adults differ in ER strategy usage (e.g., John & Gross, 2004; Nolen-Hoeksema & Aldao,
2011) and situation-specific pain catastrophizing (e.g., Ruscheweyh et al., 2011); however, these findings largely did not hold true when ER was considered as a mediator between pain-related experiences and dispositional pain catastrophizing.

While ER training is a component of established psychological interventions such as Dialectical Behaviour Therapy for personality disorders (e.g., Linehan et al., 2006), it is not a widely recognized evidence-based strategy for chronic pain management. Results from this present study demonstrating a positive predictive relationship between suppression and depression/anxiety, and the inverse relationship for reappraisal in chronic pain populations lends support to the idea of investigating clinical strategies aimed at improving chronic pain management through the disruption of fear-avoidance behaviours. Specifically, exploring the potential value of ER training in managing the impact of negative affectivity on catastrophizing response within the fear-avoidance model as part of any potential future investigation may be of value. Longitudinal investigation of the hypothesized effectiveness of this proposed intervention for addressing fear-avoidance behaviours in chronic pain clinical populations warrants further investigation.

**Conclusions**

Study 1 was the first investigation that resulted in the validation of a widely used measure of ER, the ERQ (Gross & John, 2003) in older adult samples. Previous research using the ERQ with older adults (i.e., de Frias, 2014) included a study sample age range from 51-85 years and was not exclusively focused on individuals over 65 who may be more likely to be retired than younger persons (Abeles et al., 1998). In this study, the ERQ proved to be a valid and reliable measure for assessing suppression and reappraisal
in older adults. Findings from this study are more representative and generalizable to a general older adult community sample.

The validated ERQ was then used in Study 2. Pain catastrophizing was conceptualized as a dependent or outcome variable consistent with previous research completed with chronic pain populations (Ong et al., 2010). Participant gender, as well as self-reported depression, worry, pain intensity, and fear of pain, all significantly predicted pain catastrophizing within a regression model that did not include ER strategies. As expected age did not predict catastrophizing consistent with previous investigations (e.g., Bond et al., 2015; Cano, 2004; Keefe et al., 2000; Kim et al., 2015; Leung, 2012; Ruscheweyh, et al., 2011; Severeijns et al., 2001; Sullivan et al., 1995; Sullivan, Rogers et al., 2001). ER reappraisal strategy as measured by the ERQ (Gross & John, 2003) did not predict fear of pain, pain catastrophizing, or pain intensity as measured by the SVFPQ-III (Albaret et al., 2004; McNeil & Rainwater, 1998), PCS (Sullivan et al., 1995), or SFMPQ (Melzack, 1987) respectively. Suppression strategy as measured by the ERQ did not significantly predict fear of pain (SVFPQ-III); however, as expected, it was predictive of pain intensity (SFMPQ), and pain catastrophizing (PCS) and this relationship was positive in both cases replicating previous findings (e.g., Sullivan et al., 1997; Wong & Fielding, 2013). Overall, participant gender was not a determining factor in reappraisal use amongst a chronic pain sample. With respect to this study’s male chronic pain participants, older adults reported lower reappraisal strategy and suppression strategy use than their younger male counterparts, while older females reported more reappraisal strategy use than their younger counterparts. The results of this study partially support age differences with respect to ER strategy use. These findings
are consistent with previous investigations (e.g., John & Gross, 2004). Moreover, in this study, males reported greater engagement of suppression techniques than did females consistent with the belief that males avoid emotional reactivity (Barrett & Bliss-Moreau, 2009). The mediating effects of suppression and reappraisal on the relationship between pain-related outcomes and pain catastrophizing were also investigated in this study. Eleven of the 12 models tested yielded no mediating influence or differences between the younger and older adults living with chronic pain. A single model provided evidence for the partial statistical suppressing effect of reappraisal on the relationship between affective dimensions of pain and pain catastrophizing. Contrary to hypotheses, no evidence was found to support the positive or negative mediating influence of ER suppression strategy.

The scientific literature yields inconclusive and often contradictory evidence in support of age and gender differences with regards to ER strategy implementation within non-pain populations (John & Gross, 2004; Nolen-Hoeksema & Aldao, 2011; Tamres et al., 2002). Findings from some acute and experimentally induced pain research supports the positive role of reappraisal, and the negative role of suppression (e.g., Quartana & Burns, 2007; Quartana et al., 2007; Quartana et al., 2010), while others have found no differences between the two strategies (e.g., Hampton et al., 2015). Findings are further inconclusive when examining ER in chronic pain populations that include older adults (e.g., Paquet et al., 2005). This study aimed to add to the scientific literature by clarifying ER age and gender differences within a combined older and younger adult chronic pain population. Findings from this study provide further evidence that ER strategy choice (i.e., reappraisal, suppression) likely maintains minimal influence over
pain coping and emotional reactivity in chronic pain populations. Despite this study’s findings supporting the predictive relationship between fear of pain and pain catastrophizing as well as pain intensity and pain catastrophizing in the absence of ER; neither suppression nor reappraisal strategy effectively mediated any of the aforementioned relationships. While this does not completely exclude ER strategy use in managing chronic pain outcomes it is likely that other coping strategies (e.g., Molton et al., 2008) are just as effective and possibly more influential in chronic pain management. Moreover, definitive conclusions are difficult to make with regards to the effectiveness either reappraisal or suppression in chronic pain populations since in study participants were not assigned to a specific ER strategy task (i.e., suppression or reappraisal) which is often a procedure in experimentally induced investigations (e.g., Hampton et al., 2015).
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doi:10.1016/j.psychsport.2017.10.001


Appendix A

Research Ethics Board
Certificate of Approval

PRINCIPAL INVESTIGATOR
Omeed O. Gandehari

DEPARTMENT
Psychology

REBH# 4151314

SUPERVISOR
Dr. Thomas Hadjistavropoulos

FUNDER(S)
Unfunded

TITLE
Exploring the Relationship between Pain and Emotion Regulation in Older Adults

APPROVAL OF
Recruitment Protocols (2)
Consent Form Study 1 – online consent
Consent Form Study 1 – paper consent
Consent Form – Study 2
Questionnaires – ASQ, PSWA-A, CES-D, FPQ-SF, EPQ,
ICS, SFMPSQ, Demographics

APPROVED ON
January 20, 2014

CURRENT EXPIRY DATE
January 20, 2015

CERTIFICATION
The University of Regina Research Ethics Board has reviewed the above-named research project. The proposal was found to be acceptable on ethical grounds. The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to this research project, and for ensuring that the authorized research is carried out according to the conditions outlined in the original protocol submitted for ethics review. This Certificate of Approval is valid for the above time period provided there is no change in experimental protocol, consent process or documents.

Any significant changes to your proposed method, or your consent and recruitment procedures should be reported to the Chair for Research Ethics Board consideration in advance of implementation.

ONGOING REVIEW REQUIREMENTS
In order to receive annual renewal, a status report must be submitted to the REB Chair for Board consideration within one month of the current expiry date each year the study remains open, and upon study completion. Please refer to the following website for further instructions: http://www.uregina.ca/research/REB/main.shtml

[Signature]

Dr. Larena Hoeber, Chair
University of Regina
Research Ethics Board

Please send all correspondence to:
Office for Research, Innovation and Partnership
University of Regina
Research and Innovation Centre 109
Regina, SK S4S 0A2
Telephone: (306) 585-4775  Fax: (306) 585-4893  research.ethics@uresgina.ca
Appendix B

CONSENT FORM FOR PARTICIPANT

Exploring the Relationship Between Pain and Emotion Regulation – Study 1

Principal Investigators:
Omeed Ghandehari, M.A.
Graduate Student in Clinical Psychology
Supervised by: Dr. Thomas Hadjistavropoulos
University of Regina
(306) 337-3129
Omeed.Ghandehari@uregina.ca

Thomas Hadjistavropoulos, Ph.D., ABPP (Supervisor)
Department of Psychology
University of Regina
(306) 585-4457
Thomas.Hadjistavropoulos@uregina.ca

INTRODUCTION

You have been invited to participate in this research because you are 65+ years of age and can provide information about how you handle your emotions on a daily basis.

YOUR PARTICIPATION IS VOLUNTARY

We hope that you will assist us with this research project but would like to point out that participation in this project is completely voluntary. In addition, your participation as well as all data collected from you will remain anonymous and separated from any personal identifying information.

WHO IS CONDUCTING THE STUDY?

Omeed Ghandehari, a University of Regina graduate student in clinical psychology, is conducting this study. He is supervised by Dr. Thomas Hadjistavropoulos.

BACKGROUND

The link between pain and emotion has been well documented. Emotional regulation is a process for monitoring and managing emotions. Few studies have explored how older adults manage their emotions. Understanding how older adults manage their emotions may help us develop interventions for people who have difficulty with emotional management.
WHAT IS THE PURPOSE OF THE STUDY?

The purpose of this investigation is to examine a popular measure of emotion regulation in the context of adults who are over 65 years of age.

WHO CAN PARTICIPATE IN THE STUDY?

Adults living in Canada who are 65 years of age or over can participate in this study. In addition, you must have access to a computer and the internet in order to complete the questionnaires online.

WHAT DOES THE STUDY INVOLVE?

You will be asked to complete a series of questionnaires. These questionnaires should take roughly 5-10 minutes each and no longer than 30 minutes total. You will also be asked to provide brief details about yourself such as your age. Questionnaires must be completed through the use of a computer on the internet.

WHAT ARE MY RESPONSIBILITIES?

You will be asked to complete certain questionnaires, and to provide brief information about yourself. Participation in the study is voluntary and may be declined at any time prior, during, or after the commencement of the study. Please note, once your questionnaire responses have been anonymized and separated from your identifying information, it will not be possible to withdraw your data from the research project. Responses will be anonymized within 48 hours of collection.

WHAT ARE THE POSSIBLE HARMs AND SIDE EFFECTS OF PARTICIPATING?

There are no known risks involved in this study. You can withdraw from the study at any time without penalty.

WHAT ARE THE BENEFITS OF PARTICIPATING IN THIS STUDY?

This research will help evaluate a popular measure of emotion regulation for use with people over 65 years of age. After completing your participation within the study you will have the option of entering your name and contact information in a draw to win $100 dollars. Results from this study can give information that can help other older adults who may have difficulty managing their emotions.

WHAT IF NEW INFORMATION BECOMES AVAILABLE THAT MAY AFFECT MY DECISION TO PARTICIPATE?

At this time, we are not aware of any additional information that may affect your decision. However, if that changes, we will provide you with new information about the study at a later time.
WHAT HAPPENS IF I DECIDE TO WITHDRAW MY CONSENT TO PARTICIPATE?

We hope that you will assist us with this research project but would like to point out that participation in this project is completely voluntary. Your may refuse to participate without penalty. Withdrawing your voluntary participation from the study will not impact your ability to participate in the $100 draw.

Please note, once your questionnaire responses have been anonymized and separated from your identifying information, it will not be possible to withdraw your data from the research project. Responses will be anonymized within 48 hours of collection.

AFTER THE STUDY IS FINISHED

You may request summaries of the results of this study at any time. Feel free to contact the Health Psychology Laboratory (306-585-4428) or Omeed Ghandehari (Omeed.Ghandehari@uregina.ca or 306-337-3179) at the University of Regina. Final study results will be available in the summer of 2014.

WHAT WILL THE STUDY COST ME?

There is no cost to participate in this study.

WILL MY TAKING PART IN THIS STUDY BE KEPT CONFIDENTIAL?

Your privacy will be respected. A research coordinator may have access to your data for collection, entry, and filing purposes. Regardless of their role, all individuals will follow strict professional standards when handling data. There will be no identifying information provided or detailed in any reports or publications that may result from this study. Only group results will be presented in our reports. Data will be anonymized and will be stored according to professional standards. The questionnaires will be shredded when it is time to destroy it. Likewise, all electronic data collected will be downloaded from our secure account with SurveyMonkey.com. Downloaded electronic data will be anonymized and stored on password encrypted files that will only be accessible by the researchers. All electronic data will be deleted when it is time to destroy it.

WHO DO I CONTACT IF I HAVE QUESTIONS ABOUT THE STUDY DURING MY PARTICIPATION?

This study is being conducted by Omeed Ghandehari, a graduate student in the Psychology Department, University of Regina. If you have any questions about the study please feel free to contact Omeed (Tel: 306-337-3179, Email: Omeed.Ghandehari@uregina.ca).

WHO DO I CONTACT IF I HAVE ANY QUESTIONS OR CONCERNS ABOUT MY RIGHTS AS A SUBJECT DURING THE STUDY?

This project was approved by the Research Ethics Board, University of Regina. If you have any questions or concerns about your rights or treatment as a research participant, you may contact the Chair of the University Research Ethics Board at 306-585-4775 or by e-mail at research.ethics@uregina.ca.
CONSENT FOR PARTICIPANT TO PARTICIPATE

Participant’s name: ________________________________

Please check all statements that are true:

☐ I have read and understood the subject information and consent form.
☐ I have had sufficient time to consider the information provided and to ask for advice.
☐ I have had the opportunity to ask questions and have had satisfactory responses.
☐ I understand that all of the information collected will be kept confidential and that the result will only be used for scientific objectives.
☐ I understand that my participation in this study is voluntary and that I am completely free to refuse my participation or to withdraw myself from this study at any time without penalty.
☐ I understand that once my questionnaire responses have been anonymized and separated from my identifying information, it will not be possible to withdraw my data from the research project.
☐ I understand that I am not waiving any of my legal rights as a result of signing this consent form.
☐ I understand that there is no guarantee that this study will provide any benefits to me.
☐ I have read this form and I freely consent to my participation in this study.
☐ I have been told that I will receive a dated and signed copy of this form.

Please click yes “I agree” to the above and wish to participate in this study or no “I disagree” to leave this page.

Having read the consent form, by selecting “I agree” to participate in this study and consent to the above. I also consent that the researchers may collect information from me or about me that is relevant to this study.
CONSENT FORM FOR PARTICIPANT

Exploring the Relationship Between Pain and Emotion Regulation – Study 1

Principal Investigators:  
Ommeed Ghandehari, M.A.  
Graduate Student in Clinical Psychology  
Supervised by: Dr. Thomas Hadjistavropoulos  
University of Regina  
(306) 337-3129  
Ommeed.Ghandehari@uregina.ca  

Thomas Hadjistavropoulos, Ph.D., ABPP (Supervisor)  
Department of Psychology  
University of Regina  
(306) 585-4457  
Thomas.Hadjistavropoulos@uregina.ca

INTRODUCTION

You have been invited to participate in this research because you are 65+ years of age and can provide information about how you handle your emotions on a daily basis.

YOUR PARTICIPATION IS VOLUNTARY

We hope that you will assist us with this research project but would like to point out that participation in this project is completely voluntary. In addition, your participation as well as all data collected from you will remain anonymous and separated from any personal identifying information.

WHO IS CONDUCTING THE STUDY?

Ommeed Ghandehari, a University of Regina graduate student in clinical psychology, is conducting this study. He is supervised by Dr. Thomas Hadjistavropoulos.

BACKGROUND

The link between pain and emotion has been well documented. Emotional regulation is a process for monitoring and managing emotions. Few studies have explored how older adults manage their emotions. Understanding how older adults manage their emotions may help us develop interventions for people who have difficulty with emotional management.
WHAT IS THE PURPOSE OF THE STUDY?

The purpose of this investigation is to examine a popular measure of emotion regulation in the context of adults who are over 65 years of age.

WHO CAN PARTICIPATE IN THE STUDY?

Adults living in Regina Saskatchewan who are 65 years of age or over can participate in this study.

WHAT DOES THE STUDY INVOLVE?

You will be asked to meet with a research assistant at a mutually agreed upon location. You will be provided with a questionnaire package that for your convenience you may choose to complete immediately or at a later date. These questionnaires should take roughly 5-10 minutes each and no longer than 30 minutes total. You will also be asked to provide brief details about yourself such as your age.

WHAT ARE MY RESPONSIBILITIES?

You will be asked to complete certain questionnaires, and to provide brief information about yourself. You will be asked to meet with a research assistant for the questionnaire administration and collection purposes. Participation in the study is voluntary and may be declined at any time prior, during, or after the commencement of the study. Please note, once your questionnaire responses have been anonymized and separated from your identifying information, it will not be possible to withdraw your data from the research project. Responses will be anonymized within 48 hours of collection.

WHAT ARE THE POSSIBLE HARMs AND SIDE EFFECTS OF PARTICIPATING?

There are no known risks involved in this study. You can withdraw from the study at any time without penalty.

WHAT ARE THE BENEFITS OF PARTICIPATING IN THIS STUDY?

This research will help evaluate a popular measure of emotion regulation for use with people over 65 years of age. After completing your participation within the study you will have the option of entering your name and contact information in a draw to win $100 dollars. Results from this study can give information that can help other older adults who may have difficulty managing their emotions.

WHAT IF NEW INFORMATION BECOMES AVAILABLE THAT MAY AFFECT MY DECISION TO PARTICIPATE?

At this time, we are not aware of any additional information that may affect your decision. However, if that changes, we will provide you with new information about the study at a later time.
WHAT HAPPENS IF I DECIDE TO WITHDRAW MY CONSENT TO PARTICIPATE?

We hope that you will assist us with this research project but would like to point out that participation in this project is completely voluntary. Your may refuse to participate without penalty. Withdrawal of voluntary participation from the study will not impact your ability to participate in the $100 draw. Please note, once your questionnaire responses have been anonymized and separated from your identifying information, it will not be possible to withdraw your data from the research project. Responses will be anonymized within 48 hours of collection.

AFTER THE STUDY IS FINISHED

You may request summaries of the results of this study at any time. Feel free to contact the Health Psychology Laboratory (306-585-4428) or Omeeed Ghandehari (Omeeed.Ghandehari@uregina.ca or 306-337-3179) at the University of Regina. Final study results will be available in the summer of 2014.

WHAT WILL THE STUDY COST ME?

There is no cost to participate in this study.

WILL MY TAKING PART IN THIS STUDY BE KEPT CONFIDENTIAL?

Your privacy will be respected. A research coordinator may have access to your data for collection, entry, and filing purposes. Regardless of their role, all individuals will follow strict professional standards when handling data. There will be no identifying information provided or detailed in any reports or publications that may result from this study. Only group results will be presented in our reports. Data will be anonymized and will be stored according to professional standards. The questionnaires will be shredded when it is time to destroy it.

WHO DO I CONTACT IF I HAVE QUESTIONS ABOUT THE STUDY DURING MY PARTICIPATION?

This study is being conducted by Omeeed Ghandehari, a graduate student in the Psychology Department, University of Regina. If you have any questions about the study please feel free to contact Omeeed (Tel: 306-337-3179, Email: Omeeed.Ghandehari@uregina.ca).

WHO DO I CONTACT IF I HAVE ANY QUESTIONS OR CONCERNS ABOUT MY RIGHTS AS A SUBJECT DURING THE STUDY?

This project was approved by the Research Ethics Board, University of Regina. If you have any questions or concerns about your rights or treatment as a research participant, you may contact the Chair of the University Research Ethics Board at 306-585-4775 or by e-mail at research.ethics@uregina.ca.
CONSENT FOR PARTICIPANT TO PARTICIPATE

Participant's name: ________________________________

Please check all statements that are true:

☐ I have read and understood the subject information and consent form.
☐ I have had sufficient time to consider the information provided and to ask for advice.
☐ I have had the opportunity to ask questions and have had satisfactory responses.
☐ I understand that all of the information collected will be kept confidential and that the result will only be used for scientific objectives.
☐ I understand that my participation in this study is voluntary and that I am completely free to refuse my participation or to withdraw myself from this study at any time without penalty.
☐ I understand that once my questionnaire responses have been anonymized and separated from my identifying information, it will not be possible to withdraw my data from the research project.
☐ I understand that I am not waiving any of my legal rights as a result of signing this consent form.
☐ I understand that there is no guarantee that this study will provide any benefits to me.
☐ I have read this form and I freely consent to my participation in this study.
☐ I have been told that I will receive a dated and signed copy of this form.

Having read the consent form, I agree to participate in this study and consent to the above. I also consent that the researchers may collect information from me or about me that is relevant to this study.

Your name (please print): ________________________________

Signature: ________________________________

Date: ________________________________

Witness: ________________________________

Signature: ________________________________

Date: ________________________________

Researcher: ________________________________

Signature: ________________________________

Date: ________________________________
Appendix C

CONSENT FORM FOR PARTICIPANT

Exploring the Relationship Between Pain and Emotion Regulation – Study 2

Principal Investigators:
Ommeed Ghandehari, M.A.
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Thomas Hadjistavropoulos, Ph.D., ABPP (Supervisor)
Department of Psychology
University of Regina
(306) 585-4457
Thomas.Hadjistavropoulos@uregina.ca

INTRODUCTION

You have been invited to participate in this research because you are either 65+ years of age or 35 years of age or younger and can provide information about how you handle your emotions on a daily basis.

YOUR PARTICIPATION IS VOLUNTARY

We hope that you will assist us with this research project but would like to point out that participation in this project is completely voluntary. In addition, your participation as well as all data collected from you will remain anonymous and separated from any personal identifying information.

WHO IS CONDUCTING THE STUDY?

Ommeed Ghandehari, a University of Regina graduate student in clinical psychology, is conducting this study. He is supervised by Dr. Thomas Hadjistavropoulos.

BACKGROUND

The link between pain and emotion has been well documented. Emotional regulation is a process for monitoring and managing emotions. Few studies have explored how older adults manage their emotions. Understanding how older adults manage their emotions may help us develop interventions for people who have difficulty with emotional management.
WHAT IS THE PURPOSE OF THE STUDY?

The purpose of this investigation is to examine the outcomes related to how emotions are managed in both younger and older adults living with chronic pain.

WHO CAN PARTICIPATE IN THE STUDY?

Adults (65+ years old or 35 years old or less) residing in North American who are living with chronic pain for at least 3 months and have access to a computer and the internet can participate in this study.

WHAT DOES THE STUDY INVOLVE?

You will be asked to complete a series of questionnaires. These questionnaires should take roughly 5-10 minutes each and no longer than 30 minutes total. You will also be asked to provide brief details about yourself such as your age. The questionnaires must be completed online.

WHAT ARE MY RESPONSIBILITIES?

You will be asked to complete certain questionnaires, and to provide brief information about yourself. Participation in the study is voluntary and may be declined at any time prior, during, or after the commencement of the study. Please note, once your questionnaire responses have been anonymized and separated from your identifying information, it will not be possible to withdraw your data from the research project. Responses will be anonymized within 48 hours of collection.

WHAT ARE THE POSSIBLE HARMs AND SIDE EFFECTS OF PARTICIPATING?

There are no known risks involved in this study. You can withdraw from the study at any time without penalty.

WHAT ARE THE BENEFITS OF PARTICIPATING IN THIS STUDY?

This research will help evaluate a popular measure of emotion regulation as well as to explore age-related differences with respect to emotion management. Results from this study can give information that can help other older adults who may have difficulty managing their emotions.

WHAT IF NEW INFORMATION BECOMES AVAILABLE THAT MAY AFFECT MY DECISION TO PARTICIPATE?

At this time, we are not aware of any additional information that may affect your decision. However, if that changes, we will provide you with new information about the study at a later time.
WHAT HAPPENS IF I DECIDE TO WITHDRAW MY CONSENT TO PARTICIPATE?

We hope that you will assist us with this research project but would like to point out that participation in this project is completely voluntary. Your may refuse to participate without penalty. Please note, once your questionnaire responses have been anonymized and separated from your identifying information, it will not be possible to withdraw your data from the research project. Responses will be anonymized within 48 hours of collection.

AFTER THE STUDY IS FINISHED

You may request summaries of the results of this study at any time. Feel free to contact the Health Psychology Laboratory (306-585-4428) or Omeed Ghandehari (Omeed.Ghandehari@uregina.ca or 306-337-3179) at the University of Regina. Final study results will be available in the summer of 2014.

WHAT WILL THE STUDY COST ME?

There is no cost to participate in this study.

WILL MY TAKING PART IN THIS STUDY BE KEPT CONFIDENTIAL?

Your privacy will be respected. A research coordinator may have access to your data for collection, entry, and filing purposes. Regardless of their role, all individuals will follow strict professional standards when handling data. There will be no identifying information provided or detailed in any reports or publications that may result from this study. Only group results will be presented in our reports. Data will be anonymized and will be stored according to professional standards. The questionnaires will be shredded when it is time to destroy it. Likewise, all electronic data collected will be downloaded from our secure account with SurveyMonkey.com. Downloaded electronic data will be anonymized and stored on password encrypted files that will only be accessible by the researchers. All electronic data will be deleted when it is time to destroy it.

WHO DO I CONTACT IF I HAVE QUESTIONS ABOUT THE STUDY DURING MY PARTICIPATION?

This study is being conducted by Omeed Ghandehari, a graduate student in the Psychology Department, University of Regina. If you have any questions about the study please feel free to contact Omeed (Tel: 306-337-3179, Email: Omeed.Ghandehari@uregina.ca).

WHO DO I CONTACT IF I HAVE ANY QUESTIONS OR CONCERNS ABOUT MY RIGHTS AS A SUBJECT DURING THE STUDY?

This project was approved by the Research Ethics Board, University of Regina. If you have any questions or concerns about your rights or treatment as a research participant, you may contact the Chair of the University Research Ethics Board at 306-585-4775 or by e-mail at research.ethics@uregina.ca.
CONSENT FOR PARTICIPANT TO PARTICIPATE

Participant’s name: ____________________________

Please check all statements that are true:

☐ I have read and understood the subject information and consent form.
☐ I have had sufficient time to consider the information provided and to ask for advice.
☐ I have had the opportunity to ask questions and have had satisfactory responses.
☐ I understand that all of the information collected will be kept confidential and that the result will only be used for scientific objectives.
☐ I understand that my participation in this study is voluntary and that I am completely free to refuse my participation or to withdraw myself from this study at any time without penalty.
☐ I understand that once my questionnaire responses have been anonymized and separated from my identifying information, it will not be possible to withdraw my data from the research project.
☐ I understand that I am not waiving any of my legal rights as a result of signing this consent form.
☒ I understand that there is no guarantee that this study will provide any benefits to me.
☒ I have read this form and I freely consent to my participation in this study.
☐ I have been told that I will receive a dated and signed copy of this form.

Please click yes “I agree” to the above and wish to participate in this study or no “I disagree” to leave this page.

Having read the consent form, by selecting “I agree” to participate in this study and consent to the above. I also consent that the researchers may collect information from me or about me that is relevant to this study.
Appendix D

Demographic Questionnaire

First, please tell us a little bit about yourself.

1. Gender:  M    F
2. Age:_____

3. What is your marital status?
   ___Single    ___Separated
   ___Common Law   ___Divorced
   ___Married   ___Widow/Widower

4a. Are you currently living with pain? Yes____  No____ (If no, please ignore the rest of the questions on this form)

4b. If you answered yes to the above, please tell us for how long you have been living with pain (e.g., I first noticed my pain on MM/DD/YYYY)

5a. Are you currently taking any medications for pain?  Yes______ No_______ (if yes, please proceed to question 5b, if no, skip to question 6 on this form)

5b. If you answered yes to 5a, please list the names of any medication(s) that you are currently taking as well as how often you are taking them for pain (e.g., 1x daily)

6. Please describe your pain (e.g., location, body part, or type such as arthritis)

7. How intense has your pain been in the past week (select one)?

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8. How intense has your pain been in the past month (select one)?

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</table>

9. How intense has your pain been in the past year (select one)?

<table>
<thead>
<tr>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>Pain</td>
<td>Mild</td>
<td>Pain</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

10. What percentage of an average day are you in pain? (e.g., 10%) _______