

Do Daily Fluctuations in Interpersonal Experiences
Moderate the Relation Between Catastrophizing and
Self-Efficacy In Individuals with Chronic Pain?

by

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ABSTRACT

Prevailing models describing coping with chronic pain posit that it is a complex day-to-day process that can involve psychosocial factors, including cognitive appraisals about pain, interpersonal challenges such as distressed social relationships, and reduced engagement in enjoyable experiences. Few studies, however, have applied a process-oriented approach to elaborate the relations between key pain-related appraisals, social environmental factors, and self-efficacy, a key self-appraisal for successful adaptation to chronic pain. This study used within-day daily diary methodology to test the following hypotheses: (a) increases in morning pain catastrophizing predict decreases in end of day pain self-efficacy; (b) increases in perceived stressfulness of interpersonal relations occurring during the day exacerbate the negative effects of morning catastrophizing on end-of-day pain self-efficacy; and (c) increases in perceived enjoyment of interpersonal relations occurring during the day mitigate the negative effects of morning pain catastrophizing on end of day pain self-efficacy. Within-day measures, including morning pain catastrophizing, afternoon interpersonal stress and enjoyment ratings, and end-of-day pain self-efficacy, were collected for 21 days via an automated phone system from 223 participants with widespread chronic pain. The use of diary data allowed for examination of time-varying processes related to pain adaptation. Results of multilevel regression models indicated that, consistent with prediction, increases in morning pain catastrophizing and predicted decreases in end-of-day pain self-efficacy. Contrary to prediction, changes in midday interpersonal enjoyment and stress did not moderate the within-day catastrophizing-efficacy relation. Rather increases in midday enjoyment and stable individual differences in enjoyment predicted end-of-day efficacy. Overall,

findings suggest a within-day relation between pain cognition and social context and subsequent self-efficacy, and highlight potential targets for intervention in chronic pain.

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INTRODUCTION

Individual and Social Factors Influence Adaptation to Chronic Pain

Chronic pain is a complex and pervasive medical condition that is characterized by day-to-day impairment in cognitive, emotional, and physical functioning. Estimates of chronic pain prevalence in the United States ranges from 14.6 to 64%, and signify a major clinical, social, and economic concern (Robinson & Vetter, 2009). The disabling nature of chronic pain frequently results in loss of employment and income for patients, and an estimated \$100 billion annual loss in productivity among active US workers. Not all persons with chronic pain, however, experience interference in their day-to-day functioning. Individuals vary in their adaptation, leading researchers to investigate individual difference factors that predict better adjustment. One guiding framework for these efforts has been the biopsychosocial perspective, which posits that emotional, cognitive, and social factors are all key determinants of clinical and functional outcomes in chronic pain (Turk & Monarch, 2002). Research findings indicate that there is considerable within- and between-person variability in the thoughts and behaviors employed to manage pain on a daily basis, and these pain coping efforts can have an adaptive or maladaptive effect on outcomes. The current research examined the within-day relations between two key pain-related cognitions, catastrophizing and self-efficacy, to evaluate whether daily interpersonal context moderates that relation in chronic pain patients.

How are psychological and social factors linked to disability in chronic pain? According to the Folkman and Lazarus (1984) model of stress and coping, cognitive-affective appraisals, or people's evaluation of their pain, its meaning and significance,

and the resources they have available to cope with it are all important determinants of adaptation to chronic pain. One such cognitive appraisal, pain self-efficacy, characterized by positive expectancies about one's ability to successfully cope with pain, has been proven to be a potent predictor of improved outcomes and successful adaptation in chronic pain patients (for a review, see Marks, Allegrante, & Lorig, 2005). On the other hand, excessive negative expectancies of future pain experiences, termed pain catastrophizing, has been proven to be an equally consistent and powerful predictor of poor adaptation to chronic pain (for a review, see Sullivan et al., 2001). Folkman and Lazarus (1984) emphasize, however, that appraisals of pain and coping are also context-dependent because they are strongly influenced by situational factors. In fact, there has been growing attention on the contribution of social context to the process of adapting to chronic pain on a day-to-day basis. Therefore, the purpose of this study was to evaluate how daily social experiences such as enjoyable and stressful interpersonal relations influence the two key cognitive evaluative processes, specifically pain catastrophizing and pain self-efficacy, which regulate the experience of chronic pain.

Self-Efficacy and Implications for Pain-Related Outcomes

When faced with the threat of pain, individuals make an initial evaluation of whether they have the resources to cope with the pain. Individuals with chronic pain often feel helpless and handicapped, as physical pain is often not amenable to control. The severity or duration of a physical pain condition, however, has been shown to account for only a modest degree of variance in physical and psychological disability (Turner, Jensen, & Romano, 2000; Jensen, Romano, Turner, Good, & Wald, 1999). Rather, psychological factors such as pain-related beliefs and appraisals have often found

to be more important determinants of outcomes in chronic pain patients (Denison, Asenlof, & Lindberg, 2004; Arnstein, 2000; Jensen, Turner, & Romano, 2001).

Among the numerous psychological factors that influence adjustment to chronic pain conditions, self-efficacy has been established as an important appraisal that is predictive of positive emotional, physical, and functional outcomes for chronic pain patients. Self-efficacy is defined as individuals' belief in their ability to successfully organize and execute specific behaviors to achieve desired outcomes (Bandura, 1977). According to Bandura, self-efficacy expectancies play a central role in determining behavior, the amount of effort exerted when engaging in the behavior, and the willingness to persist in the behavior in the face of obstacles or aversive experiences (Bandura, 1997).

There has been a great deal of interest in the role of self-efficacy in the process of coping with chronic pain. Among studies linking these variables, pain-related self-efficacy is generally measured as patients' confidence in their ability to manage pain and other stressors generated by pain (Lorig & Holman, 1998). Studies in arthritis patients have shown that individuals with chronic pain vary in their self-efficacy for managing pain, with some individuals feeling confident in their ability to cope with pain, and others feeling unable to manage (Lorig, Chastain, Ung, Shoor, & Holman, 1989). An individual's appraisal of his or her ability to cope, despite aversive pain experiences, is associated with meeting daily life demands with adaptive strategies such as persisting in activities despite pain, pacing activities, and using coping self-statements (Turner, Ersek, & Kemp, 2005).

Pain self-efficacy has been shown to be an important predictor of emotional distress, well-being, and physical symptoms. For example, higher self-efficacy expectations consistently predict lower levels of stress, anxiety, and depression (Lowe et al., 2008; O’Leary, Shoor, Lorig, & Holman, 1998; Arnstein, Caudill, Mandle, Norris, & Beasley, 1999; Nicassio, Schuman, Radojevic, & Weisman, 1999; Miro, Martinez, Sanchez, Prados, & Medina, 2011). Pain self-efficacy has also been shown to account for a significant proportion of variance in physical health outcomes such as pain perception, with patients with higher self-efficacy reporting lower pain (Pells et al., 2008). In studies of experimentally manipulated pain, persons with higher self-efficacy display higher tolerance and threshold for pain, and view it as less threatening and unpleasant (Keefe et al., 1997; Weisenber, Schwarzald, and Tepper, 1996).

Beyond its importance for emotional and physical health outcomes, pain-related self-efficacy beliefs have also been shown to affect physical activity and behavioral adjustment to chronic pain. The amount of time and effort individuals will expend on a task, and the willingness to persist despite challenges and unpleasant experiences are key to reducing disability and distress in chronic pain patients. Several studies have demonstrated that persons with higher self-efficacy experience less interference from pain to their daily physical functioning (Miro, Martinez, Sanchez, Prados, & Medina, 2011; Menezes, Maher, McAuley, Hancock, & Smeets, 2011; Arnstein, 2000). In addition to performance of everyday activities, higher self-efficacy has also been associated with fewer pain behaviors (Buckelew et al., 1994; Buescher et al., 1991). Of note, pain behaviors such as avoidance of certain activities and complaining about pain are associated with worsening of functional outcomes (Fordyce, 1976). In a prospective

study, Asghari & Nicholas (2001) found that higher self-efficacy at the beginning of the 9-month study predicted fewer pain behaviors and less pain avoidance even after controlling for other disease variables such as pain intensity, pain chronicity, depression, catastrophizing, and neuroticism.

Because self-efficacy is consistently linked to a host of markers of better adaptation, several researchers have suggested its inclusion as a target in interventions for chronic pain (e.g., Marks, Allegrante, & Lorig, 2005; Turner, Ersek, Kemp, 2005; McKnight, Afram, Kashdan, Kasle, & Zautra, 2010). Treatment-outcome studies have shown that an increase in pain-related self-efficacy is not only related to improvements in psychological and functional variables such as reduced helplessness, anxiety, depression, and fatigue, and pain perception, but that it is also important to long-term maintenance of treatment gains (Chui, Lau, & Yau, 2004; Lorig, Mazonson, & Holman, 1993; Keefe, Cadwell, et al., 1996; for a review, see Marks, 2001). Higher pain self-efficacy levels has also been shown to predict better attendance and participation in intervention programs, medication compliance, and adherence to health recommendations such as diet, exercise, medication, and activity adjustment (Brus van de Laar, Taal, Rasker, & Wiegman, 1999; Keefe, Rumble, Scipio, Giordano, & Perri, 2004; Grurcsik, Estabrooks, & Frahm-Templar, 2003; Taal, Rasker, Seydel, & Wiegman, 1993). Along with improving treatment compliance, longitudinal trials have also showed that improved self-efficacy post-treatment predicts long-term benefits such as better functioning and reduced illness behavior at follow-up (Kores, Murphy, Rosenthal, Elias, & North, 1990; Rejeski, Miller, Foy, Messier, & Rapp, 2001; Altmaier, Russell, Kao, Lehmann, & Weinstein, 1993). For example, Smarr and colleagues (1997) found strong associations between increases in

self-efficacy following treatment and long-term improvement in several clinically important measures such as depression, pain perception, health status, and disease activity. Therefore, over and above the cross-sectional studies, these treatment outcome studies provide even stronger evidence for significance of self-efficacy for adaptation to chronic pain.

Although there is strong support for the role of dispositional or person-level self-efficacy in improving emotional, physical and functional outcomes in chronic pain patients, few researchers have attempted to examine this coping appraisal as a process. Bandura (1997) emphasized that self-efficacy expectations are context-dependent and are continually modified by daily life experiences. Therefore, further research at the within-person level is required to fully understand the implications of context-specific pain self-efficacy.

Pain Catastrophizing and Implications for Vulnerability to Pain Disability

In the cognitive context of coping with pain, while appraisals such as a belief in the ability to cope and persevere when faced with aversive pain experiences are considered positive strengths, there are also maladaptive cognitive responses that can be powerful predictors of adaptation and outcomes for chronic pain patients. Having catastrophic thoughts about pain, in particular, has consistently been shown to be inversely related to self-efficacy and is a central source of interference to adaptive responses in chronic pain (Keefe et al., 1997; Shelby et al., 2008). Pain-related catastrophizing is the tendency to magnify perception of pain as being worse than it is or making exaggerated predictions about its damaging consequences (Sullivan, Bishop, & Pilvik, 1995; Rosenstiel & Keefe, 1983). The overly negative self-statements that are

characteristic of catastrophizing reflect feeling overwhelmed, helpless and pessimistic about coping with pain. It is further characterized by exaggerated cognitive and affective reactions such as fear, rumination, and inability to divert attention away from expected or the actual pain experience (Sullivan et al., 2001).

A propensity to catastrophize about pain has been associated with several negative outcomes, including higher levels of negative affect (Hirsh, George, Riley, & Robinson, 2007), increased risk of depression (Lee, Chan, & Berven, 2007; Sullivan, Rodgers, & Kirsch, 2001; Keefe et al., 1991), and greater anxiety (Sullivan, Bishop, & Pivik, 1995) and overall emotional distress (Moldovan, Onac, Vantu, Szentagotai, & Onac, 2009). Pain catastrophizing has also been linked to reporting elevated pain severity (Sullivan, Bishop, & Pivik, 1995; Sullivan, Rodgers, & Kirsch, 2001), and to maintenance and exacerbation of pain intensity (Wolff et al., 2008; Edwards & Fillingim, 2005). Functional disability has also been consistently predicted by pain catastrophizing in several chronic pain populations including fibromyalgia (FM: Nicassio, Schoenfeld-Smith, Radojevic, & Schuman, 1995; Martin et al., 1996), rheumatoid arthritis (Keefe, Brown, Wallston, & Caldwell, 1989; Parker et al., 1989), and low back pain (Smeets et al., 2006), with the association between pain catastrophizing and increased disability often present even after controlling for depression, anxiety, neuroticism, and disease and pain severity (Sullivan, Stanish, Waite, Sullivan, & Tripp, 1998; Martin et al., 1996). The link between pain catastrophizing and disability is further supported by prospective studies showing baseline levels of catastrophizing predicting disability at long-term follow-up (Keefe, Brown, Wallston, & Caldwell, 1989; Picavet, Vlaeyen, & Schouten, 2002).

Some studies have suggested that catastrophizing is not a risk factor for the onset of pain, but is predictive of the pain experience being persistent and severe (Picavet et al., 2002; Edwards, Fillingim, Maixner, Sigurdsson, & Haythornthwaite, 2004). The association of pain catastrophizing with increased disability may be due in part to high versus low pain catastrophizers focusing more attention and coping efforts on potential or actual pain signals. Studies have shown that high pain catastrophizing is strongly predictive of heightened attention or hyper-vigilance to the threat of pain (Crombez, Eccleston, Van, Goubert & Van Houdenhove, 2004; Goubert, Crombez, & Van Damme, 2004). Furthermore, in addition to focusing more on the pain, high pain catastrophizers also have greater difficulty disengaging from pain signals compared to low pain catastrophizers (Van Damme, Crombez, Eccleston, 2004). Van Damme, and colleagues (2004) suggest that as high pain catastrophizers are more worried and fearful of anticipated pain, they process pain signals more thoroughly and are more fixated on them. Low catastrophizers, on the other hand, viewed the anticipated pain as less threatening, inhibited additional processing of the pain signals, and directed attention to other environmental stimuli. These studies support the fear-avoidance model, which is a theoretical framework explaining how catastrophic interpretation of pain contributes to pain-related fear and promotes avoidance behaviors (Vlaeyen & Linton, 2000; Leeuw et al., 2007; Buer & Linton, 2002). In brief, this model posits that although avoidance may be adaptive in the acute pain stage by preventing further injury, for chronic pain sufferers, fear of pain may lead to consistent avoidance of important daily activities. Thus, the heightened attention to pain, difficulty disengaging from the threat of pain, worry, and

avoidance behaviors may explain the longer term process through which person-level pain catastrophizing has a deleterious effect on physical and emotional functioning.

Due to its significant link to outcomes, a propensity to catastrophize has been explored as a mechanism of change in chronic pain treatments. Smeets et al. (2006) found that reductions in pain catastrophizing following treatment-mediated improvements in functioning for patients with chronic low back pain. Spinhoven et al. (2004) also found that a decrease in overt pain behaviors (such as verbal and nonverbal complaints and distorted perceptions of mobility) following treatment was mediated by a change in pain catastrophizing. Furthermore, change in the level of catastrophizing has also been shown to mediate improvements in pain intensity, depression, activity interference, disability, and functional outcomes following treatment (Cassidy, Atherton, Robertson, Walsh, & Gillett, 2012; Spinhoven et al., 2004; Turner, Holtzman, & Mancl, 2007; Smeets et al., 2006).

Results of treatment studies demonstrate the importance of catastrophizing and self-efficacy appraisals in mediating and sustaining improvements in pain outcomes, but in the opposite directions. Pain catastrophizing is associated with increased disability and poor adaptation, whereas pain self-efficacy predicts a more resilient response. Thus, while both constructs are beliefs about one's ability to cope with chronic pain, they tend to be inversely related (Asghari & Nicholas, 2001). Left unexplored, however, is the question of how these coping appraisals unfold in an acute pain coping episode.

Having catastrophic or exaggerated expectations that the current pain will lead to worse outcomes is likely to reduce self-efficacy, which reflects an individual's belief in the ability to cope with the pain. Lazarus and Folkman (1984) describe coping as a

process in which individuals continually appraise and reappraise their relationship with stressors such as actual pain or the threat of future pain. In the process of coping, a negative appraisal such as catastrophizing prompts an increase in negative thoughts, hypervigilance to pain, fear and worry about the consequences of pain, negative mood, and avoidance behaviors, which can then be expected to interfere with the development of confidence in having the personal resources to cope with pain. On the other hand, we may surmise that factors that have a decatastrophizing effect can be expected to result in higher levels of self-efficacy. Moreover, this interaction between appraisals and reappraisals occurs over time and is likely to be affected by changes in the environment that are distinct from the person. For example, situational changes in the environment may lead an individual to reevaluate the significance of pain and her capacity to cope with it. The impact of social context on the process of coping is now being elaborated with research supporting that interpersonal experiences can have considerable influence on cognitive, emotional, and behavioral responses to chronic pain.

Social Context and Implications for Adaptation to Chronic Pain Coping

Biopsychosocial models of chronic pain emphasize the importance of the role that social environment plays in adaptation to chronic pain (Keefe and France, 1999). To develop a more accurate understanding of the complexity of chronic pain, researchers have been increasingly considering the ecological environment of chronic pain patients, which includes the dynamic relationship between interpersonal relations, the pain experience, and coping efforts. Although several studies have established the importance of social relationships to dispositional coping style (Buenaver, Edwards, & Haythornthwaite, 2007; Meredith, Strong, & Feeney, 2005), few have addressed the

interrelationships between day-to-day changes in inter-personal experiences and intra-personal pain cognitions.

When considering the impact of social context and interpersonal processes on the disease course in chronic pain patients, both positive and negative interpersonal interactions should be taken into account. Depending on its nature, an interpersonal event can alter pain coping behaviors and cognitions in both adaptive and maladaptive ways. Among chronic pain patients, increases in daily negative interpersonal events have been associated with poorer same-day functional and emotional outcomes (Parrish, Zautra, & Davis, 2008; Finan et al., 2010). There may be several processes by which psychosocial stressors lead to poorer illness course in chronic pain patients. For example, studies have shown that changes in daily stressful interpersonal experiences are associated with greater disease activity (Schanberg et al., 2000). In a study examining the role of stressful interpersonal interactions in an experimental setting, Schwartz, Slater, and Birchler (1994) randomized chronic pain patients and their spouses to either a stressful interpersonal interview or a neutral talking task, followed by a physical activity task. The researchers found that the pain patients in the stress interaction condition were significantly more likely to terminate the physical activity task compared to those in the control condition. The impact of daily psychosocial stressors on outcomes, therefore, may occur via their influence on pain behaviors such as activity avoidance and withdrawal. Furthermore, an increase in daily negative interpersonal events has also been associated with same-day increases in negative affect (Finan et al., 2010), depressed mood (Nezlek & Allen, 2006) and fatigue (Parrish, Zautra, & Davis, 2008). Thus, by increasing maladaptive coping behaviors, fatigue, and negative affect, day-to-day social

stressors may further diminish the adaptive capacity of people already distressed by chronic pain, leaving them unable to interrupt maladaptive pain cognitions, like catastrophizing.

Daily increases in positive interpersonal interactions, on the other hand, have been shown to be associated with better same-day outcomes such as a higher level of positive affect and lower level of fatigue (Zautra, Affleck, Tennen, Reich, & Davis, 2005; Parrish, Zautra, & Davis, 2008). Researchers have suggested several processes by which enjoyable interpersonal experiences may lead to improved outcomes in chronic pain patients. For example, positive interpersonal events may serve as a distraction from pain and reduce the importance given to it (Katz, Ritvo, Irvine, & Jackson, 1996).

Additionally, satisfying interpersonal relationships may serve as a buffer by supplying individuals with resources to cope with the illness and by increasing their self-efficacy. Such a phenomenon was noted in a daily diary study by Taylor and colleagues (2013), who showed that on days of increased pain, chronic pain patients living happily with a spouse or partner tend to use more adaptive pain coping strategies, and have better coping efficacy and functional health compared to unhappily partnered or unmarried pain patients. Moreover, changes in pain self-efficacy partially accounted for the enhanced capacity of happily partnered pain patients to limit pain-related disability and preserve in physical functioning.

Chronic pain patients frequently rely on their spouses or other family members for emotional and functional support (Zautra, Guarnaccia & Reich, 1989). Receiving pain-relevant social support can have a stress-buffering effect and protect against psychological distress (Brown et al., 1989; Kerns, Rosenberg, & Otis, 2002). A lack of

social support, on the other hand, can contribute to the etiology of depression in individuals with chronic pain (Creed & Ash, 1992). On a daily basis, how might boosts in positive interpersonal relations facilitate optimal functioning in pain patients? One possibility is that increases in positive relations may limit pain related increases in maladaptive cognitions such as catastrophizing and/or interrupt the harmful effects of catastrophizing on self-efficacy for coping with pain. As noted earlier, being in a satisfying romantic relationship boosted patients' sense of their own efficacy in coping with pain during days of high pain (Taylor, Davis, & Zautra, 2013). Moreover, within-day, when patients report increased satisfaction with spouse support, the negative effect of catastrophizing on pain-related outcomes was attenuated (Holtzman & DeLongis, 2007). To date, however, no study has examined the moderating effects of daily changes in relational context on the within-day process of cognitive pain coping.

Understanding Contextual Processes in Pain Coping and Goals of the Current Study

Although cognitive appraisals of pain self-efficacy and pain catastrophizing are well-established as central components for adapting to chronic pain and improving health outcomes, further research is required to understand the effect of the social environment on these appraisal processes. The overall goal of this study was to examine whether changes in daily interpersonal context moderates the within-day relation between pain-catastrophizing and self-efficacy. To understand the ecology of pain management in daily life, the fluctuating relations among cognitive appraisals and interpersonal experiences—within each individual—need to be taken into consideration. However, the majority of studies that explore cognitive variables or social context have relied heavily

on cross-sectional or prospective data. Researchers have been increasingly arguing for the importance of assessing momentary states in the study of chronic pain (e.g., Sorbi, et al., 2006). In addition to being able to study patients in their natural or home environment and collecting data in real time, this method allows for concise measurement of dynamic pain processes and different sources of variance in within-day coping with pain (Stone, Broderick, Shiffman, & Shwartz, 2004). Therefore, to evaluate within-day associations among multiple inter- and intra-personal variables, the current study used an electronic daily diary methodology and capitalized on within-day assessments.

Several cross-sectional and longitudinal studies that have shown that the effect of stable, person-level catastrophizing on pain-related outcomes is mediated, at least in part, by self-efficacy (McKnight, Afram, Kashdan, Kasle, & Zautra, 2010; Shelby et al., 2008; Woby, Urmston & Watson, 2007). In other words, individual differences in catastrophizing predict self-efficacy, which, in turn predicts outcomes such as physical functioning, pain, and disability. This study sought to build on these findings, by first examining the relations between within-person changes in pain-catastrophizing in the morning and pain self-efficacy in evening. Specifically, the first hypothesis was that an increase in pain-catastrophizing early in the day would predict poorer pain self-efficacy later in the day (see Figure 1).

As noted above, in one of the few studies using a within-day process methodology, Holtzman and DeLongis (2007) showed that in the context of increased morning satisfaction with spousal responses, the harmful interrelations between changes in pain and subsequent negative affect and catastrophizing were disrupted. However, studies examining the effects of day-to-day and especially within-day social experiences on the

pain coping process have been very sparse. Most studies that have examined the impact of daily interpersonal relationships have focused on emotional (Bolger, DeLongis, Kessler, & Schilling, 1989), functional (Taylor, Davis & Zautra, 2013; Ward & Leigh, 1993) and physical health (Parrish, Zautra, & Davis, 2008; Finan et al., 2010) outcomes. Though Lazarus and Folkman (1984) emphasized the importance of evaluating cognitive appraisals in situation-specific context, researchers have rarely investigated the potential interaction between daily changes in the social environment and fluctuations in the cognitive coping process. By collecting data via multiple time points across participants and situations, pain coping appraisals such as catastrophizing and self-efficacy can be understood as part of the ongoing interactions with the social environment rather than as static events.

Therefore, the second aim of the current study was to evaluate whether the deleterious effect of pain-catastrophizing on pain self-efficacy is moderated by interpersonal experiences occurring during the day. In addition to considering psychosocial factors that hinder successful adaptation to chronic pain, researchers have argued for the importance of considering how a patients' social environment can also enable adaptive responses and positive outcomes (Yeung, Arewasikporn, & Zautra, 2012). Hence, this study evaluated the moderating influence of within-person daily changes in both positive and negative experiences through use of daily appraisals of both enjoyable and stressful interpersonal events. Specifically, the second hypothesis was that boosts in interpersonal enjoyment occurring during the day would dampen the harmful effect of increases in pain-catastrophizing on pain self-efficacy (Figure 2), and the third hypothesis was that

boosts in interpersonal stress would exacerbate the relation between increases in pain-catastrophizing and decreases in pain self-efficacy (Figure 3).

Among interpersonal relationships, marital processes have garnered the most empirical attention and have consistently been shown to be a main contributing factor in chronic pain management (Grant, Long, & Willms, 2002; Manne & Zautra, 1989). However, other relationships such as those with friends or coworkers can also be an important and influential part of a patient's daily social context. In fact, interventions are being developed that target not only intra-individual characteristics (beliefs, etc.), but also interpersonal characteristics such as job stress and interpersonal conflict in the workplace (Sullivan, Feuerstein, Gatchel, Linton, & Pransky, 2005; Sullivan & Standish, 2003). To capture the impact of a broader interpersonal environment, this study assessed enjoyment and stress appraisals across multiple interpersonal relations domains, including those with spouses, friends, family, and coworkers.

This study examined the moderating role of interpersonal relations on the within-day association between pain-catastrophizing and pain coping self-efficacy in individuals with chronic pain due to FM. FM is a chronic musculoskeletal pain syndrome characterized by widespread pain lasting longer than 6 months, fatigue, sleep difficulties, and psychological distress, with a prevalence of 3.4% in the U.S. population (Wolfe, 1990). FM is especially relevant for the current study because evidence suggests that individuals with FM have deficits in emotion regulation, including lower levels of positive affect (Zautra et al., 2005; Finan, Zautra, & Davis, 2009), greater stress reactivity (Zautra, Hamilton, & Burke, 1999), and greater social dysfunction than other chronic pain disorders (van Koudil et al., 2010; Davis, Zautra, & Reich, 2001). Pain self-efficacy

has been shown to be an important variable in understanding pain coping and psychological functioning in individuals with FM, including predicting improved outcomes (Culos-Reed & Brawley, 2003; Van Liew et al., 2013), especially following treatment (Buckelew et al., 1996; Dobkin et al., 2010). Further, pain catastrophizing has also been shown to be an potent predictor of poor outcomes in individuals with fibromyalgia (Burckhardt et al., 1997; Martin et al., 1996), leading researchers to suggest that targeting catastrophic thoughts in interventions may improve both psychological and physical functioning in persons with fibromyalgia (Hassett, Cone, Patella, & Sigal, 2000).

METHODS

Participants

Participants were recruited in the Phoenix metropolitan area using print and online advertisements, physician referrals, and fibromyalgia support groups to participate in a larger treatment outcome study for fibromyalgia. Participants were included in the study if they met the following inclusionary criteria: 1) were between ages 18 and 72; 2) had self-reported pain, either, a) lasting three months or longer in at least three of the four quadrants of the body, or b) lasting three months or longer in at least two of the four quadrants of the body with significant fatigue and sleep disturbance; 3) passed a tender point assessment conducted by a licensed nurse to verify FM diagnosis according to American College of Rheumatology criteria (Wolfe et al., 1990); 4) had no diagnosed autoimmune or neuropathic pain disorders; 5) were not involved in litigation related to their pain condition; and 6) were not currently participating in other an research study, clinical trial, or counseling for pain or depression.

Procedure

Participants were first screened for eligibility by telephone. Those who screened eligible were visited at home by a registered nurse who administered a tender point exam to confirm FM diagnosis. Participants who met pain eligibility criteria were consented and introduced to the study procedure. Next, participants completed (a) an initial questionnaire packet including measures of physical health, emotional health, and pain; (b) a phone interview assessing psychological health and life events; (c) a laboratory assessment of physiological and affective responses to pain and emotional stimuli; (d) pre-intervention questionnaires regarding current symptoms and physical and emotional functioning; and (e) 21 days of diary reports regarding interpersonal events, pain, fatigue, sleep quality, mood, and coping. Participants were then randomly assigned to one of three 7-week treatment conditions. Following the treatment, participants completed post-intervention assessments identical to those in pre-treatment, and completed six- and twelve-month follow-up questionnaires.

The data for the current study were drawn from the pre-intervention diary portion of the larger project. Diary data from 223 participants were included in the study. The diaries assessed the participants' physical symptoms, functional health, pain cognitions and coping efforts, interpersonal relations, and affects during the day. Participants were provided with a cell phone and were trained by a member of the research team on how to complete the phone diaries. For up to 21 days, participants were prompted four times per day to complete daily reports. An automated phone system called each of the participants each morning 20 minutes following his/her specified wake up time for the morning

interview, and at 11 a.m. for the late-morning interview, at 4 p.m. for the afternoon interview, and within 30 minutes of bedtime for the end-of-day interview. If the participant missed the call, s/he could call the system within two and half hours to complete the call. Furthermore, call completions and progress were routinely monitored by laboratory staff, and participants were encouraged to call our staff immediately if a problem occurred with the phone system. Participants were paid \$2 for each day they completed diaries, with a bonus of \$1/day for rates of completion that were 50%.

The diary data, with multiple assessments across the day, enabled a closer look at the fluctuations among the study variables within participants from morning to evening. The temporal ordering of variables allowed for examination of questions such as, “Does higher than usual pain catastrophizing in the morning predict lower pain self-efficacy at the end of the day?” and “Will higher than usual interpersonal enjoyment attenuate the detrimental effects of morning pain-catastrophizing on end-of-day pain self-efficacy?” Therefore, the main hypotheses for this study drew on morning reports of pain and pain-catastrophizing, midday appraisals of interpersonal events, and end-day-reports of self-efficacy.

Measures

A copy of all study measures are included in the Appendix.

Morning Pain Catastrophizing. Daily pain catastrophizing was assessed with an item drawn from the Pain Catastrophizing subscale (PC) of the Coping Strategies Questionnaire (Keefe et al., 1989), which assesses the extent to which patients engage in negative self-statements and overly negative thoughts about their pain. Participants were asked to rate the statement, “You felt your pain was so bad you couldn’t stand it

anymore” using a scale of 1 to 5 with 1 meaning “Not at all” and 5 meaning “completely.”

End-of-day Pain Self-Efficacy. Efficacy for managing pain was assessed by asking participants to rate the statement “If you had a similar pain experience again, how certain are you that you would be able to cope well with its negative aspects?” using a scale of 1 to 5 with 1 meaning “not at all” and 5 meaning “completely” (Zautra & Wrabetz, 1991).

Midday Appraisal of interpersonal events. Participants rated their perceived interpersonal stress and perceived interpersonal enjoyment using ratings from the Inventory of Small Life Events (ISLE; Zautra, Guarnaccia, & Dohrenwend, 1986). Participants were asked to respond to the statement, “During the past 2-3 hours, how stressful (or enjoyable) were your relations with your spouse or partner (friends, family, co-workers), on a scale of 1 to 5?” using a scale of 1 to 5 with 1 meaning “not at all” and 5 meaning “completely.” The perceived stress and enjoyment measures were formed as the average of 4 ratings of the stressfulness and enjoyment that followed inquiries into the daily occurrence of interpersonal events in each of these 4 domains: (1) spouse or partner; (2) family; (3) friends and acquaintances; and (4) co-workers.

Morning Pain. Daily average pain was measured in the diary on a 101-point numerical rating scale (Jensen, Karoly, & Braver, 1986). Participants were asked, “What was your overall level of pain? Enter a number between 0 and 100 that best describes your pain level. A zero would mean ‘no pain’ and a one hundred (100) would mean ‘pain as bad as it can be.’”

Data Analytic Strategy

This study used a multilevel modeling approach for data analysis because the data are structured such that each participant provided multiple daily reports across a 21-day period. This nested design allowed for both within- and between-person comparisons. Because observations per participant occur within-day over 21 days, there was a high likelihood of missing data. Multilevel modeling is useful in this respect because it includes observations from all participants, regardless of whether they completed every assessment.

The study had two levels consisting of days (Level 1 or within-person) nested within individuals (Level 2, person-level, or between-person). The first level (within-person) is comprised of an individual's daily reports that ask participants about their experiences during the day. To disaggregate the between- from the within-person variation included in the daily reports, these reports were centered within-person. Specifically, each participant's daily score was subtracted from his/her mean score for that variable over all days of assessment; thus, each person-centered score is Level 1 and signifies each day's deviations from an individual's mean across all their days of assessment. This process of centering around each individual's own average ensured that analyses tested "when" a phenomenon is occurring. For between-person analysis, the intercept was sample centered by subtracting each participant's average score on a specific variable from the group's average on the same variable. Thus, the individual's mean score on measures across days reflects Level 2. As an example of the two levels, centered pain-catastrophizing reflects the level 1 day-to-day deviations from an individual's average pain-catastrophizing score (i.e., "when" someone is catastrophizing)

whereas mean pain-catastrophizing across the 21 days represents the level 2 between-person variable of catastrophizing (i.e., a person is a catastrophizer). Level 1 person-centered scores are uncorrelated with Level 2 score on the same variable, facilitating interpretation of effects (Enders & Tofighi, 2007). Intraclass correlation coefficients (ICC) were computed using unconditional multilevel models to quantify the proportion of variance at the between-person level relative to the total variance. The ICC values for pain-catastrophizing, pain self-efficacy, interpersonal enjoyment, interpersonal stress, and pain are .45, .47, .48, .36, and .50, respectively, in the current sample. These ICC values suggest that there is substantial within-person variability, and that the two sources of variability (i.e., within- and between-person) can be best modeled within a multi-level framework (Kaplan, Kim & Kim, 2009).

To test the first hypothesis that an increase in morning pain-catastrophizing would predict poorer end-of-day pain self-efficacy, a multilevel regression analysis. The equation was as follows:

$$(1) \text{ Daily pain self-efficacy} = \beta_0 + \beta_1 \text{ change in morning pain-catastrophizing} + r.$$

The second and third hypotheses predicted that changes in daily interpersonal enjoyment or stress would moderate the relations of pain-catastrophizing and pain self-efficacy. The following models tested these hypotheses:

$$(2) \text{ Daily Pain Self-Efficacy} = \beta_0 + \beta_1 \text{ change in morning pain-catastrophizing} + \beta_2 \text{ change in midday interpersonal enjoyment} + \beta_3 \text{ change in morning pain-catastrophizing} \times \text{change in midday interpersonal enjoyment} + r.$$

(3) Daily Pain Self-Efficacy = $\beta_0 + \beta_1$ *change in morning pain-catastrophizing* + β_2 *change in midday interpersonal stress* + β_3 *change in morning pain-catastrophizing X change in midday interpersonal stress* + r .

In these equations, β_0 provides an estimate for the intercept for daily pain self-efficacy, β_1 represents the slope of the relation between the change in pain-catastrophizing and daily pain self-efficacy, β_2 represents the slope of the relation between change in interpersonal enjoyment or stress and daily pain self-efficacy, and β_3 represents the moderating effect of change in interpersonal enjoyment or stress on the slope of the relation between change in pain-catastrophizing and daily pain self-efficacy. Finally, r is the within-person residual. A significant pain-catastrophizing X interpersonal enjoyment or stress interaction was graphed according to the method recommended by Aiken and West (1991) to determine whether the nature of the interaction is consistent with the hypothesis. The grand mean of all the intercepts, the within-subjects residual/error (r), and the between-subjects error (deviation of each participant's mean from the grand mean) (u_0) were specified as random effects. The remaining variables in the model were specified as fixed effects.

Further, to assess if the impacts of positive and negative relations have separable effects, the following equation combining both interpersonal stress and interpersonal enjoyment variables was used to test each of their unique contribution to the explanation of daily pain self-efficacy:

(4) Daily Pain Self-Efficacy = $\beta_0 + \beta_1$ *change in morning pain-catastrophizing* + β_2 *change in midday interpersonal enjoyment* + β_3 *change in morning pain-catastrophizing X change in midday interpersonal enjoyment* + β_4 *change in midday*

interpersonal stress + β_5 change in morning pain-catastrophizing X change in midday interpersonal stress + r.

Lastly, evidence suggests that increases in pain intensity are associated significantly with subsequent increase in catastrophizing about pain (Turner, Mancl, & Aaron, 2004). Therefore, the analyses were repeated including morning pain as a predictor to determine if morning pain-catastrophizing significantly predicted outcomes, over and above concurrent pain ratings. In other words, does morning pain-catastrophizing account for significant variance in the outcome beyond that accounted for by morning pain intensity ratings? To test this hypothesis, analysis 2 and 3 were repeated with morning pain included in the model.

(2b) Daily Pain Self-Efficacy = $\beta_0 + \beta_1$ *change in morning pain-catastrophizing* + β_2 *change in midday interpersonal enjoyment* + β_3 *change in morning pain-catastrophizing X change in midday interpersonal enjoyment* + β_4 *morning pain intensity* + *r.*

(3b) Daily Pain Self-Efficacy = $\beta_0 + \beta_1$ *change in morning pain-catastrophizing* + β_2 *change in midday interpersonal stress* + β_3 *change in morning pain-catastrophizing X change in midday interpersonal stress* + β_4 *morning pain intensity* + *r.*

Finally, exploratory analyses were conducted to examine: 1) the role of individual differences (i.e., level 2) in interpersonal joy and stress as moderators of the relation between centered pain catastrophizing and end-of-day pain self-efficacy; 2) whether end-of-day pain self-efficacy predicted next morning pain catastrophizing, controlling for today's pain catastrophizing; and 3) whether changes in interpersonal joy and/or stress

mediated the relation between morning pain catastrophizing and end-of-day pain self-efficacy.

RESULTS

Demographics

Table 1 shows the sample demographic characteristics. Participants comprising the sample were largely female (87%), Caucasian (78%), and employed (50.7%). They reported an average age of 51 years ($SD= 11.02$; range = 19-72), being married or living with a romantic partner (55%), attending at least some college (68%), and a median annual household income range between \$30,000-\$39,999. Intercorrelations between demographic variables and key study person-level variables are depicted in Table 2. They revealed that females reported less pain-catastrophizing and more interpersonal enjoyment than males. Older people reported less pain, interpersonal joy, and stress than younger people. People who were partnered had more interpersonal joy and less pain-catastrophizing and stress than those who were not partnered. People who were employed reported less pain-catastrophizing and interpersonal stress, and more pain self-efficacy than those who were unemployed. People with higher incomes had more interpersonal enjoyment and pain self-efficacy, and less pain-catastrophizing, pain, and interpersonal stress than those with lower incomes.

Table 3 presents the means, standard deviations, and ranges, and Table 4 the intercorrelations for between-person study variables. Based on average scores in the sample as a whole, individuals reported catastrophizing about their pain “a little,” and feeling efficacious about their ability to cope with their pain “quite a bit.” Similarly, on

average, they reported experiencing interpersonal stress “a little,” but interpersonal enjoyment “quite a bit.” On average, levels of daily pain were near the middle of the 0-100 scale. Participants reported higher levels of interpersonal enjoyment ($M=3.29$, $SD=.80$) than stress ($M= 1.87$, $SD= .72$). In general, person-level pain-catastrophizing was characterized by reports of higher pain and interpersonal stress, and lower pain self-efficacy and interpersonal joy. Additionally, pain self-efficacy was characterized by lower levels of pain and interpersonal stress, and more interpersonal enjoyment. Pain was associated with lower reports of interpersonal enjoyment and greater stress. Lastly, interpersonal joy and stress were inversely related.

Intercorrelations between person-centered daily measures can be found in Table 5. State pain-catastrophizing was correlated with higher reports of pain, and lower levels of interpersonal enjoyment and pain self-efficacy. State pain self-efficacy was associated with lower pain and higher interpersonal joy. Lastly, state interpersonal joy was inversely related to pain and interpersonal stress.

State Pain-Catastrophizing and Interpersonal Stress and Enjoyment Predicting Pain Self-Efficacy

Hypothesis 1 predicted that an increase in person-centered pain-catastrophizing would predict poorer pain self-efficacy at the end of the day. Consistent with the hypothesis, elevations in centered pain-catastrophizing in the morning significantly predicted less evening pain self-efficacy, over and above morning pain ($t = -6.57$, $p <.001$).

The second and third hypotheses predicted that centered daily interpersonal experiences (i.e., enjoyment and stress) would moderate the relation between increases in pain-catastrophizing and pain self-efficacy. Specifically, hypothesis 2 stated that an increase in midday centered interpersonal enjoyment would attenuate the impact of state pain-catastrophizing on pain self-efficacy. Results of the model testing hypothesis 2 are depicted in Table 6. The findings show that an elevation in midday interpersonal joy predicted more pain self-efficacy ($t = .203, p < .05$) and an elevation in morning pain-catastrophizing predicted lower pain self-efficacy ($t = -2.61, p < .01$); however, contrary to prediction, the interaction between the state pain-catastrophizing and interpersonal joy variable was not significant ($t = .47, p = \text{n.s.}$). Thus, change in interpersonal joy does not moderate the relation between increased state morning pain-catastrophizing and evening pain self-efficacy.

Hypothesis 3 stated that an increase in midday centered interpersonal stress would exacerbate the impact of detrimental effect of centered pain-catastrophizing on pain self-efficacy (see Table 6). The findings show, as noted above, that an increase in morning centered pain-catastrophizing predicted lower evening pain self-efficacy ($t = -2.61, p < .01$), but an increase in centered interpersonal stress at midday did not predict evening pain self-efficacy ($t = -.72, p = \text{n.s.}$). Contrary to prediction, the interaction between increases in centered pain-catastrophizing and interpersonal stress was also not significant ($t = -.70, p = .48$). Therefore, centered interpersonal stress was neither a significant predictor of pain self-efficacy nor a moderator of the relation between centered pain-catastrophizing and pain self-efficacy.

Hypothesis 4 tested if positive and negative interpersonal experiences contribute uniquely to pain self-efficacy, by including both variables together in the model. Results from a model including both centered stress and enjoyment are depicted in Table 7, and show that elevations in centered interpersonal joy and centered catastrophizing both predicted changes in pain self-efficacy, but centered stress and the stress X catastrophizing and joy X catastrophizing interactions were unrelated to changes in pain self-efficacy. Thus, centered morning-pain catastrophizing and midday interpersonal joy are the only significant predictors of end-of-day pain self-efficacy.

Exploratory Analyses

State Pain-Catastrophizing and Person-level Interpersonal Stress and Enjoyment

Predicting Pain Self-efficacy

To probe the impact of stable mean-level interpersonal stress and joy on pain self-efficacy, analyses for Hypotheses 2 and 3 were repeated substituting person-level interpersonal variables for within-person centered interpersonal variables (see Table 8). While person-level interpersonal stress ($t = -3.03, p < .01$) and centered morning pain-catastrophizing ($t = -6.54, p < .01$) significantly predicted increased pain self-efficacy, their interaction did not ($t = .19, p = .85$). Similarly, in a model with person-level interpersonal joy, centered pain-catastrophizing, and their interaction, controlling for morning pain, the main effects for person-level joy ($t = 7.49, p < .01$) and catastrophizing ($t = -6.79, p < .01$) were significant, but the interaction was only marginally significant ($t = 1.76, p = .08$). Post hoc probing of the interaction was carried out according to Aiken and West (1991) to determine the magnitude and direction of the within-person path across the between-

person moderator. Figure 4 depicts the simple slopes showing the moderating role of interpersonal enjoyment at the between-person level on the relation between fluctuations in morning pain-catastrophizing and end-of-day pain self-efficacy. The two regression lines in the figure for the two between-person values of high (1 SD above the mean) and low (1 SD below the mean) interpersonal enjoyment represent the regression of end-of-day pain self-efficacy (Y axis) on within-person high (1 SD above the mean) and low (1 SD below the mean) morning pain-catastrophizing. The interaction depicted in this figure shows that the detrimental effect of increased morning pain-catastrophizing on end-of-day pain self-efficacy is marginally stronger for individuals with high versus low person-level interpersonal joy.

Lastly, the analysis was repeated including both person-level interpersonal stress and joy in the model. Here, centered pain-catastrophizing ($t = -6.67, p < .01$) and person-level interpersonal joy ($t = 6.73, p < .01$) both significantly predicted pain self-efficacy, but person-level interpersonal stress ($t = .55, p < .59$) did not. Moreover, the interaction between centered pain-catastrophizing and person-level joy was also significant ($t = 2.24, p < .05$), but the interaction between centered pain-catastrophizing and person-level stress was not.

Random Effects Analyses

In previous analyses, only the intercept was specified as a random effect. However, in addition to random intercepts, it is possible that these models might contain random slopes. The presence of random slopes would indicate that the magnitude and possibly the direction of the relation between morning catastrophizing and pain self-efficacy or between afternoon interpersonal experiences and pain self-efficacy might vary

substantially from person to person. Therefore, analyses were performed to investigate whether random slopes were present for significant effects. In the first set of analyses, centered catastrophizing was included as a random effect in the prediction of end-of-day pain self-efficacy, and it was indeed a random effect. With centered catastrophizing as a random effect in a model containing centered catastrophizing, centered interpersonal joy, and their interaction, the fixed effect for catastrophizing became only marginally significant in the prediction of pain self-efficacy ($t = -1.79, p = .07$). In a similar model with interpersonal stress replacing interpersonal joy and continuing to model catastrophizing as a random effect, the fixed effect of catastrophizing on pain self-efficacy was again marginally significant ($t = -1.87, p = .06$). In the second set of analyses, centered interpersonal joy was included alone as a random effect in the prediction of end-of-day efficacy, but did not have a significant random slope. These findings indicate that the influence of pain-catastrophizing on pain self-efficacy is not uniform across participants and that it fluctuates in magnitude and/or direction from person to person.

In summary, when considered together in a final model (depicted in Table 9), significant predictors of end-of-day pain self-efficacy include centered catastrophizing and interpersonal joy, and person-level interpersonal joy. A marginally significant interaction between person-level interpersonal joy and centered pain-catastrophizing suggested that the inverse relation between centered pain catastrophizing and end-of-day pain self-efficacy is weakened among people who are low versus high in person-level interpersonal joy, opposite of prediction.

Lagged Analysis with Evening Increases in Pain Self-efficacy Predicting Next-Day Catastrophizing

To evaluate whether one day's increases in pain self-efficacy predict next-day catastrophizing, a model was tested with today's centered evening pain self-efficacy predicting tomorrow's catastrophizing, after controlling for today's morning catastrophizing and pain raw scores. Findings are depicted in Table 10 and revealed that elevations in evening pain self-efficacy were not predictive of pain-catastrophizing the next morning ($t = -1.37, p = .17$).

Analyses Exploring the Mediating Role of Interpersonal Experiences

Two regression models evaluated whether 1) change in interpersonal joy or 2) change in interpersonal stress mediated the effect of change in morning pain-catastrophizing on end-of-day pain self-efficacy, controlling for morning pain. Mediation effects were tested using the Baron and Kenny (1986) procedures in the following steps: 1) regression analyses tested if change in pain-catastrophizing significantly predicted end-of-day pain self-efficacy (the c path); 2) second set of analyses tested if change in morning pain-catastrophizing significantly predicted midday interpersonal experiences (the a path); 3) third set of regression analyses tested if change in midday interpersonal experiences significantly predicted pain self-efficacy over and above centered morning pain-catastrophizing (the b path). For both models, interpersonal joy and stress, the a paths were not significant, meaning that morning-pain catastrophizing did not significantly predict midday interpersonal joy [$b = -.02, t(1365) = -.80, p = .43$] or stress [$b = .01, t(1362) = .48, p = .63$]. Therefore, results of the mediation analyses indicated that the morning change in pain-catastrophizing → evening pain self-efficacy relation was not significantly mediated by change in either midday interpersonal joy or interpersonal stress.

DISCUSSION

Prevailing models of coping with chronic pain suggest that to fully understand the process of individual adaptation to pain, the interplay between fluctuating pain-related appraisals and situational social factors should be taken into account (Kenny & Zautra, 1995; Lazarus & Folkman, 1984). The current study tested the hypothesis that increases in morning catastrophizing would predict decreases in end-of-day pain self-efficacy, and examined whether fluctuations in social joy and stress moderated that relation in individuals with chronic pain. The results of the current study indicate that, as hypothesized, daily levels of morning pain catastrophizing are significantly related to decreases in end-of-day self-efficacy. However, contrary to prediction, neither momentary increases in interpersonal joy nor stress at midday substantially moderated the relation between elevations in pain catastrophizing in the morning and self-efficacy at the end of day.

Prior studies with chronic pain sufferers have consistently identified pain catastrophizing as a key predictor of poor outcomes in the adjustment to chronic pain (Severeijns, Vlaeyen, Van Den Hout & Weber, 2001; Turner, Jensen, Warmes & Cardenas, 2002), including decreased self-efficacy (Asghari & Nicholas, 2001; Lumley, Smith & Longo, 2002). However, whereas previous research reporting a substantial association between catastrophizing and self-efficacy has been cross-sectional, the current study tested the temporal ordering of these appraisal variables, suggesting a directional relation from increases in morning pain catastrophizing to greater decreases in self-efficacy later in the day. Researchers have argued for the importance of considering the consequences of within-person variation in catastrophizing independent of stable

average levels of catastrophizing (Sturgeon & Zautra, 2013; Campbell et al., 2010), and also of the need for daily process studies to address questions concerning sequential relations between daily fluctuations in catastrophizing on pain-related outcomes (Turner, Mancl & Aaron, 2004). The findings from the daily process methodology used in this study demonstrate that when pain catastrophizing is high, there is a subsequent worsening of pain self-efficacy, even after adjusting for morning pain levels.

Although the analyses suggested that the most potent influence on end-of-day self-efficacy was that of morning pain catastrophizing, changes in enjoyable interpersonal experiences occurring at midday was also predictive of later pain self-efficacy. One potential path through which positive social experiences influence self-efficacy is through affect. An increase in positive affect derived from positive interpersonal experiences may mediate the relation between increased enjoyable social experiences and pain self-efficacy. Davis and colleagues (2010) found that on days when chronic pain patients experienced increased positive interpersonal events, a boost in positive affect mediated the decrease in same-day fatigue.

Exploratory analyses in the current study looking at the role of general levels of interpersonal experiences indicated that individuals high in person-level interpersonal enjoyment also reported higher pain self-efficacy. Individuals who regularly have more positive exchanges may also have more social support, and feeling supported by others may help bolster or sustain a sense of coping efficacy. Evidence suggests that higher levels of perceived social support are related to lower levels of chronic pain (Feldman, Downey & Schaffer-Neitz, 1999) and more effective adjustment to chronic illness (Robinson & Riley, 1999). Therefore, for individuals who consistently have more

enjoyable social experiences, a stable positive context as well as small boosts in positive events may serve as resilience factors. However, future work exploring these mechanisms will help to determine the process by which situational increases and consistent higher levels of social enjoyment give rise to increases in positive expectations of one's ability to cope with pain.

Interestingly, an elevation in daily stressful interpersonal experiences at midday did not significantly predict reduced self-efficacy at the end of day. Our data appear to contradict Baumeister, Bratlavsky, Finkenauer, and Vohs' (2001) argument that when pitted against each other, the influence of daily unpleasant events and negative interpersonal interactions are stronger than positive ones on measures of subsequent mood, cognitions, and everyday adjustment. What might explain the lack of impact of the negative interpersonal context on the intra-individual pain coping process? This lack of an effect may be, in part, due to low levels of interpersonal stress reported in our sample. The mean daily stress reported in our sample was 1.87 on a scale of 1 to 5, while other samples in other diary studies of people with chronic pain have reported a mean of 5.68 on a scale of 1 to 9 (Genet & Siemer, 2012), 5.50 on a scale of 1 to 7 (Longua, DeHart, Tennen, & Armeli, 2009), 4.43 on a scale of 1 to 7 (Ng & Diener, 2013), and 3.10 on a scale of 1 to 4 (Farmer & Kashdan, 2012). Moreover, if the effect of daily increases in interpersonal stress on reduced same-day pain self-efficacy is mediated by negative affect, the day-to-day stressful social incidents reported by participants in the study may not have been distressing enough to substantially reduce self-efficacy. Alternatively, the detrimental impact of these minor interpersonal stressors may not have lasted until the assessment of pain self-efficacy, which was measured several hours later.

In future studies, inclusion of more frequent repeated assessment of affect along with interpersonal and coping appraisals will be required to determine whether this explanation is a valid one. Lastly, another possible explanation of these findings is that cross-valence effects of negative interpersonal experiences on the oppositely valenced positive appraisals of one's ability to cope may not have been robust. In other words, end-of-day self-efficacy ratings, which is a positive coping appraisal, may have been more responsive to similarly-valenced affective stimuli, i.e., enjoyable interpersonal events, than to negatively-valenced stressful events.

Curiously, contrary to prediction, neither transitory interpersonal stress nor joy substantially moderated the relation between elevations in pain catastrophizing in the morning and self-efficacy at the end of day. The results of the current study do not support the hypothesized buffering role of enjoyable social experience in the day-to-day cognitive coping process. Holtzman and DeLongis (2007), however, found evidence for the buffering role of the daily positive social context. In their study, when participants' experienced an increase in satisfaction with their spouses' responses to participants' pain in the morning, the detrimental effect of morning increases in catastrophizing on evening negative affect was attenuated. Therefore, it may be possible that satisfaction with spousal responses to pain episodes may be more effective than increases in general social enjoyment at disrupting the harmful effect of catastrophizing. Moreover, it is also possible that satisfaction with support may buffer the within-day catastrophizing-negative affect relation, but not the one between catastrophizing and a positive outcome such as self-efficacy. Lastly, unlike in the Holtzman et al. (2007) study where catastrophizing and the moderating variable, satisfaction with spousal response, were measured

concurrently, the moderating social variables in the current study were measured several hours after catastrophizing. Therefore, the buffering effect of a positive social context may occur at different time lags than those assessed in the current study. Further research is needed to test these possibilities.

Although the interpersonal variables in the current study did not play a moderating role at the within-person level, there was a marginal interaction between higher between-person interpersonal enjoyment and morning pain-catastrophizing in predicting end-of-day self-efficacy. In other words, while moments *when* individuals experience increases in interpersonal joy did not modulate the harmful effect of pain-catastrophizing on self-efficacy, the within-day pain coping process was different for individuals *who* generally experience higher levels of joyful interpersonal experiences. The findings of these analyses show that for both groups of people, those with high and low person-level joy, pain self-efficacy is worse on days when they are catastrophize more. However, compared to individuals with low average levels of social joy, those with higher levels of social joy experience a greater decline in pain self-efficacy when they catastrophize more than usual. The weaker decline in pain self-efficacy during times of higher catastrophizing among individuals with low interpersonal joy may be, in part, because these are individuals with chronically low self-efficacy. However, for individuals who experience high stable levels of enjoyment, on days when their catastrophic thoughts are stronger than usual, the damage to their sense of self-efficacy is greater. This finding is also in line with the temporal self-comparison theory, which states that individuals compare their current self to the past to evaluate if their functioning has improved or declined (Albert,1977). When individuals who generally have high

levels of interpersonal enjoyment have catastrophic thoughts about their pain, they may experience a greater deviation from their usual cognitive-affective state in comparison to individuals who generally have low levels of interpersonal enjoyment. This discrepancy in their self-perception on days of high pain-catastrophizing might make it more difficult for individuals with high social joy to feel efficacious in their ability to cope with pain. On the other hand, for individuals who are accustomed to less positive exchanges, a day of increased catastrophizing may not be as inconsistent with their usual mental state, and thus not increasing their vulnerable to declines in self-efficacy.

Contrary to expectation, the findings of the current study provide no support for the hypotheses that pleasant or undesirable interpersonal experiences modulate the cognitive pain coping process over the day. This absence of significant findings related to the social context raises the question of what possible intra-personal processes might instead account for the effect of morning increases in pain-catastrophizing on lower pain self-efficacy at the end of day. Two such possible influences might be avoidance of pain and withdrawal from valued activities. Returning to Lazarus and Folkman's (1984) transactional model of stress and coping, exaggerated worries about one's ability to cope with pain interferes with the development of self-efficacy because individuals dwell on their pain or the threat of pain, and interpret it as being out of their control. This sense of helplessness about one's ability to deal with pain leads to further maladaptive cognitive processes such as hypervigilance to pain or the anticipation of pain onset. When attention is narrowed to this threat, opportunities for adaptive self-regulation become limited because switching to other adaptive behaviors or cognitions is also attentional demanding. Such narrowing of response choices due to an inability to divert attention

away from pain-related thoughts is also in accordance with the fear-avoidance model of chronic pain. This model presents a cognitive and behavioral theoretical framework suggesting that when the pain experience is interpreted in a catastrophic way, it fosters both maladaptive emotional (fear) and behavioral (avoidance) responses. As pain preventative behaviors can be protective in the short term, an avoidant response pattern is acquired through associative learning (Meulders, Vansteenwegen, & Vlaeyen, 2011). In other words, defensive avoidance behaviors become a conditioned response to the fear of pain. Moreover, as catastrophizing has been shown to be associated with high levels of situational anxiety and sadness (Sullivan, Bishop, Pivik, 1995), such negative affective states might further fuel focus on threat-related cues, and behavioral avoidance.

In addition to the use of strategies to escape or avoid pain, catastrophizing may also predict poor outcomes through another maladaptive pain management approach: withdrawal from engagement in valued activities. When preoccupied with the fear of pain, chronic pain sufferers refrain from initiating desirable activities or persisting in meeting meaningful goals. They may also withdraw socially from friends and family, thereby cutting off beneficial social support. Researchers have argued that sustaining engagement in desirable activities and pursuit of meaningful goals are important determinants of resilient outcomes (Sturgeon & Zautra, 2013; Kranz, Bollinger & Nilges, 2010). In fact, higher activity engagement has often been found to be associated with improved self-efficacy (Fish, Hogan, Morrison, Stewart, & McGuire, 2013; Culos-Reed & Brawley, 2003; Buckelew, Murray, Hewett, Johnson, & Huyser, 1995).

Therefore, catastrophizing about pain may contribute to vulnerability factors such as lower self-efficacy by increasing maladaptive pain responses such as avoidance and

withdrawal from rewarding experiences. If so, interventions promoting acceptance, which is the willingness to experience pain and engage in activities despite pain, may help individuals interrupt the harmful pain catastrophizing process. Several studies have shown that an increase in acceptance is associated with decreases in catastrophizing (Weiss et al., 2013; Vowles, McCracken & Eccleston, 2008). Combating the narrowing of attention to pain related fear and avoidance that occurs with catastrophizing with acceptance-based responses might reduce cognitive burden and increase the ability to identify adaptive psychological and social resources. Acceptance may also disrupt the rigid defensive response patterns associated with catastrophizing and increase motivation for participation in daily activities and pursuit of values goals. Moreover, increased awareness and acceptance of the pain experience have also been shown to be associated with increased self-efficacy for coping with pain (Trousselard et al., 2010; Wallace, Harbeck-Weber, Whiteside, & Harrison, 2010; Davis & Zautra, 2013; Zautra et al., 2008).

Another noteworthy finding to consider before drawing conclusions about the significance of these findings for clinicians treating individuals with chronic pain is that our random effects analysis shows that the magnitude of the relation between morning catastrophizing and self-efficacy was not the same from person to person. Therefore, it is valuable to consider possible individual difference factors that explain the variability in this relation. For instance, individuals with chronic pain may vary in their general tendency to catastrophize about pain. The association with self-efficacy may differ for habitual versus less-frequent catastrophizers. Individuals who have a higher tendency to catastrophize may be more vulnerable to the narrowing effects of catastrophizing because

they have formed stronger fear-avoidance associations. They may repeatedly employ maladaptive self-regulatory strategies such as ruminating about the pain or avoiding pursuing meaningful goals. Moreover, functional limitations that accompany chronic pain may also have a detrimental effect on an individual's core self-identity. Individuals who habitually catastrophize about their pain may view themselves as more disabled and helpless. These individuals may exhibit a stronger negative slope between pain catastrophizing and self-efficacy.

On the other hand, the relation between morning pain-catastrophizing and evening pain self-efficacy may vary from person to person due to adaptive individual difference constructs such as optimism and self-control. Research has shown a negative association between higher dispositional optimism, which is the general tendency to expect positive outcomes, and catastrophizing (Hood et al., 2012). Low pain catastrophizers may be more optimistic, which would foster greater confidence to overcome or cope with the negative effects of pain (Scheir and Carver, 1987). High psychological resilience, the capacity to resourcefully rebound from adversity, is also predictive of lower pain catastrophizing (Ong, Zautra, & Reid, 2010; Karoly & Ruchman, 2006). Therefore, individuals less inclined to catastrophize about pain may be more capable of sustaining adaptive functioning despite pain and other illness-related constraints. Moreover, a recent study exploring the relation of trait self-control and positive outcomes found that individuals with higher self-control are more likely to use approach oriented strategies such as initiating activities that promote well-being and less inclined to use avoidance oriented strategies such as efforts to prevent negative outcomes (Cheung, Gillebaart, Kroese & De Riddler, 2014). Hence, the low catastrophizers may also have higher self-

control that enables them to better manage the conflict from competing goals and flexibly chose behaviors that promote positive expectations of one's ability to cope with pain.

These low catastrophizing individuals may exhibit a zero or weaker negative slope between pain catastrophizing and self-efficacy.

Limitations, Strengths, and Future Directions for Research

The current study has some important limitations that should be acknowledged. First, the assessment of pain catastrophizing and pain self-efficacy using only one item each means that our findings about these constructs should be interpreted with some care. Only one item was included because it was felt that these items adequately reflected the constructs and to keep the daily assessments brief. However, the one item measure likely does not capture the multidimensional nature of the pain coping appraisal constructs. For example, previous researchers have reported that pain catastrophizing appears to have a more complex factor structure, comprised of three separate dimensions, including rumination, magnification, and helplessness, which was not completely represented in the current assessment (Sullivan, Bishop, & Pivik, 1995). Similarly, researchers have identified various domains within self-efficacy (i.e., self-efficacy for pain, self-efficacy for physical functioning, and self-efficacy for managing other symptoms of the chronic pain condition) that are important for different aspects of the daily coping process. Therefore, the associations among the variables may have varied if a full-scale measure of the cognitive coping appraisals were used. In other words, more comprehensive measures of pain catastrophizing and pain self-efficacy could have revealed more specific influential factors accountable for the current findings. Moreover, the interpersonal variables were assessed by aggregating the spousal, familial, friendship, and work

domains together. The effects of each specific social domain on the within-day cognitive coping process may have been diluted. In the future, in addition to using more comprehensive coping appraisal measures, researchers may consider also consider assessing social domains individually to better understand the influence of daily social lives on cognitive coping process.

Some additional potential limitations also deserve comment. All the participants in this study had fibromyalgia and had volunteered to take part in a larger treatment outcome study. Hence, the extent to which the current findings generalize to other chronic pain populations and to non-treatment seeking community-dwelling individuals remains to be seen. Also, the associations between the predictors, day-to-day changes in positive interpersonal experiences and pain-catastrophizing, and the outcome, pain self-efficacy, were quite small. For example, a one-unit increase in interpersonal enjoyment per day is related to only about a .04-point increase in same-day pain self-efficacy on a 1 to 5 point scale. However, interpersonal experiences occur on a daily basis and their effects, albeit small, might accrue over time in such daily diary studies, and the compounded effects could potentially have meaningful long-term impact on an individual's confidence about their ability to manage their pain.

Despite these limitations, the current study has some notable strengths. The multiple data points collected across each day for 21 days permitted an examination of the temporal ordering of variables and a much more valid and reliable estimate of the within-day interplay between the appraisal and social variables compared to studies that rely on concurrent measures. Moreover, in addition to the current study tracking the predictive role of both positive and negative interpersonal factors that influence pain self-

efficacy appraisals each day, the use of daily assessments also allowed for the differentiation of momentary, situational sources of influence from the stable, person-level contribution of the cognitive and social factors to the day-to-day adaptation process among individuals with chronic pain.

In sum, findings from the current study highlight the growing emphasis in the chronic pain literature on day-to-day fluctuations in psychosocial coping process. Multi-level analytic techniques such as those used in this study allow for assessment of within-person context-specific patterns of adjustment to chronic pain. Several studies have emphasized the importance of a positive social context for affective and physiological outcomes among individuals with chronic pain (Finan et al., 2010; Parrish, Zautra, & Davis, 2008; Zautra, Affleck, Tennen, Reich & Davis, 2005). Although there is strong evidence that a person's social environment matters, it is important to consider how, when and for whom interpersonal factors should be targeted for change in chronic pain interventions. The results of the current study indicate that interventions to increase interpersonal enjoyment may have direct effects on appraisals of self-efficacy, but they cannot be expected to moderate the within-day cognitive coping appraisal process. They may also be the case that enjoyment in interpersonal exchanges may not be most powerful target for improving pain coping. Rather, it may be valuable to capitalize on more meaningful interpersonal variables such as social support (Holtzman & DeLongis, 2007) and social connectedness (Reich et al., 2010; Jaremka, et al., 2013) for improving adaptation to chronic pain. Moreover, individual difference factors such as culture, personal history, and illness-related features may also shape how people appraise or engage in social environments, especially during times of increased pain. Also, as the

current findings provide further evidence that pain catastrophizing has a detrimental effect on pain self-efficacy, it would be important to extend this relation and explore its significance for functional outcomes. Lastly, developing a more cohesive model of daily pain coping process that takes into account cognitive, affective and social constructs may be important for developing more effective tailored treatment for individuals with chronic pain.

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Tables

Table 1
Sample Characteristics

Measures	Mean or % (SD)
Age	51.25 (11.02)
Gender	
Male	11.2
Female	87.0
Education	
5-8 years	0.4
Not completed high school	1.8
Completed high school	13.0
Post high school/business/trade	13.4
1-3 years of college	33.2
4 years of college	17.5
Post graduate	17.0
Marital Status	
Never married	8.1
Married	46.6
Widowed	5.8
Divorced	27.4
Separated	1.4
Living with romantic partner	8.7
Employment	
Working Full-Time	23.3
Working Part-Time	27.4
Not working	47.1
Race/Ethnicity	
Caucasian	78.0
Black/African American	2.7
Asian	1.3
Hispanic	14.3
Native American	4.0
Native Hawaiian/Pacific	0.9
Islander	
Other	3.6
Income	
Under \$3,000-\$20,999	25.6
\$21,000-\$39,999	22.0
\$40,000-\$59,999	17.9
\$60,000-\$99,999	19.7
\$100,000-\$149,999	7.2
\$150,000 and over	0.9

Table 2
Intercorrelations Of Demographic and Between-Person Study Variables

Measures	Catastrophizing	Pain	Interpersonal Stress	Interpersonal Joy	Self- Efficacy
Female Gender	-.21**	-.11	-.14	.17*	.08
Age	.10	-.15*	-.16*	-.15*	-.15
Education	-.09	-.10	-.02	.08	-.01
Married or Partnered	-.15*	-.05	-.24**	.15*	.09
Employed	-.19**	-.17*	-.10	.10	.19**
Income	-.29**	-.19**	-.29**	.26**	.28**
Caucasian	-.12	-.04	.01	.04	-.07

Note: * $p < .05$; ** $p < .01$; *** $p < .001$. The sample size for correlations ranges from 207-223.

Table 3

Descriptive Statistics Of Between-person Variables Across All Days (N= 221)

Measures	M(SD)	Observed Range	Skewness	Kurtosis
Catastrophizing	2.14(.81)	1-5	.51	-.36
Pain	48.72(17.88)	0-93	-.18	-.26
Interpersonal Joy	3.29(.80)	1-5	.02	-.15
Interpersonal Stress	1.87(.72)	1-5	.83	.31
Self-Efficacy	3.53(.83)	1-5	-.14	-.38

Descriptive Statistics Of Within-person Variables

Measures	M(SD)	Observed Range	Skewness	Kurtosis
Catastrophizing	0(.84)	-3 – 4	.83	1.47
Pain	0(16.87)	-74 – 64	-.16	1.76
Interpersonal Joy	0(.83)	-3 – 4	-.31	.73
Interpersonal Stress	0(.82)	-3 – 4	1.04	2.10
Self-Efficacy	0(.64)	-3 – 4	-.44	1.69

Table 4

Intercorrelations Of Between-Person Variables Across All Days (N= 221)

Measures	1	2	3	4	5
1 Catastrophizing	-				
2 Pain	.73**	-			
3 Interpersonal Joy	-.29**	-.22**	-		
4 Interpersonal Stress	.28**	.14*	-.49**	-	
5 Self-Efficacy	-.61**	-.56**	.46**	-.49**	-

Note: *p<.05; **p<.01; ***p<.001.

Table 5

Intercorrelations Of Daily Variables Centered Within-Person

Measures	1	2	3	4	5
1 Catastrophizing	-				
2 Pain	.52**	-			
3 Interpersonal Joy	-.07**	-.09**	-		
4 Interpersonal Stress	.02	.02	-.30**	-	
5 Self-Efficacy	-.22**	-.20**	.07**	-.03	-

Note: *p<.05; **p<.01; ***p<.001.

Table 6
Models Testing Hypotheses 2 and 3: Morning Catastrophizing, Midday Interpersonal Joy and Stress, Their Interactions, And Covariate Morning Pain Predicting Self-Efficacy

Predictors	<i>B(SE)</i>	<i>df</i>	<i>p-value</i>
Hypothesis 2			
Δ Catastrophizing	-.06(.02)	1242	<.01
Δ Joy	.04(.02)	1242	.04
Δ Catastrophizing*Δ Joy	.01(.02)	1242	.63
Pain	-.01(.01)	1242	<.01
Hypothesis 3			
Δ Catastrophizing	-.07(.02)	1239	<.01
Δ Stress	-.01(.02)	1239	.47
Δ Catastrophizing*Δ Stress	-.02(.02)	1239	.48
Pain	-.01(.01)	1239	<.01

Note: Δ denotes person-centered variables.

Table 7
*Model Testing Hypothesis 4 With Centered Midday
 Interpersonal Joy and Stress in the Model To Test For Their
 Unique Contribution To Evening Self-Efficacy*

Predictors	<i>B(SE)</i>	<i>df</i>	<i>p-value</i>
Δ Catastrophizing	-.06(.02)	1237	.01
Δ Joy	.04(.02)	1237	.04
Δ Stress	-.01(.02)	1237	.94
Δ Catastrophizing*Δ Joy	.01(.03)	1237	.75
Δ Catastrophizing*Δ Stress	-.01(.03)	1237	.66
Pain	-.01(.01)	1237	<.01

Note: Δ denotes person-centered variables.

Table 8
Models Predicting Self-Efficacy from Centered Catastrophizing, and Person-level Interpersonal Joy and Stress, and Their Interaction, Covarying Morning Pain

Predictors	<i>B(SE)</i>	<i>df</i>	<i>p-value</i>
A. Person-level Midday Interpersonal Joy			
Person-level Joy	.46(.06)	206	<.01
Δ Catastrophizing	-.10(.02)	3095	<.01
Δ Catastrophizing* Joy	.03(.02)	3095	.08
Pain	-.01(.01)	3095	<.01
B. Person-level Midday Interpersonal Stress			
Person-level Stress	-.22(.07)	206	<.01
Δ Catastrophizing	-.10(.02)	3095	<.01
Δ Catastrophizing* Stress	.01(.02)	3095	.85
Pain	-.01(.01)	3095	<.01
C. Person-level Midday Interpersonal Joy and Stress			
Person-level Joy	.48(.07)	205	<.01
Person-level Stress	.04(.08)	205	.59
Δ Catastrophizing	-.10(.02)	3094	<.01
Δ Catastrophizing* Joy	.04(.02)	3094	.03
Δ Catastrophizing* Stress	.02(.02)	3094	.16
Pain	-.01(.01)	3094	<.01

Note: Δ denotes person-centered variables.

Table 9

End-of-day Pain Self-Efficacy Predicted from Person-level Joy, Centered Catastrophizing and Joy, Covarying Morning Pain, Including Random Effects

Predictors	<i>B(SE)</i>	<i>df</i>	<i>p-value</i>
Person-level Joy	.47(.07)	203	<.01
Δ Catastrophizing	-.06(.03)	1243	.05
Δ Joy	.04(.02)	1243	.04
Pain	-.01(.01)	1243	<.01

Note: Δ denotes person-centered variables.

Table 10

Next Morning Catastrophizing Predicted From Centered Evening Self-Efficacy, Controlling For Morning Catastrophizing And Pain

Predictors	<i>B(SE)</i>	<i>df</i>	<i>p-value</i>
Today's Daily Catastrophizing	.06(.02)	2883	<.01
Today's Δ Self-Efficacy	-.03(.02)	2883	.17
Today's Daily Pain	.01(.01)	2883	<.01

Note: Δ denotes person-centered variables.

Figures

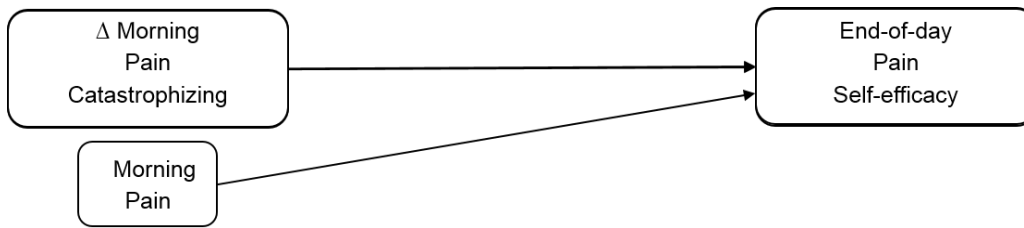


Figure 1. Change in morning pain-catastrophizing predicting end-of-day pain self-efficacy, controlling for morning physical pain.

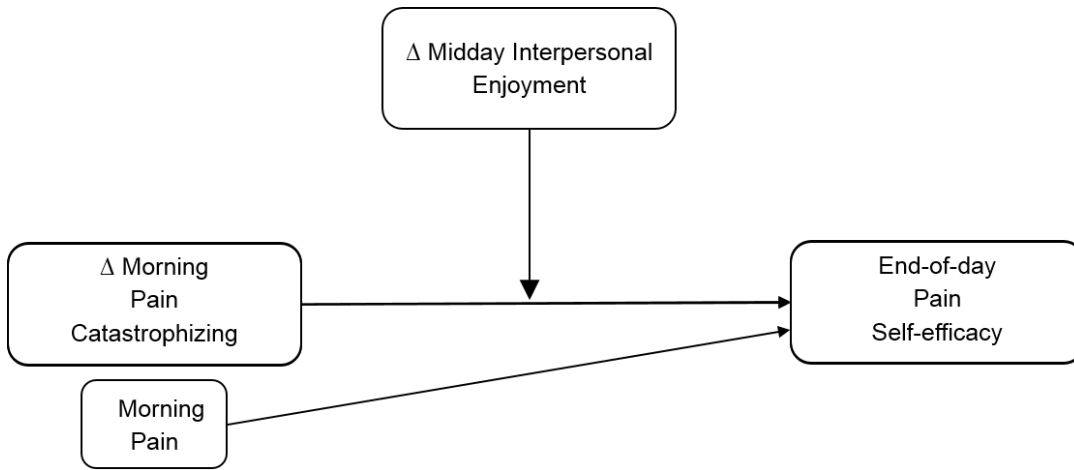


Figure 2. The moderating effect of change in afternoon interpersonal enjoyment on the relation between morning pain-catastrophizing and end-of-day pain self-efficacy, controlling for morning physical pain.

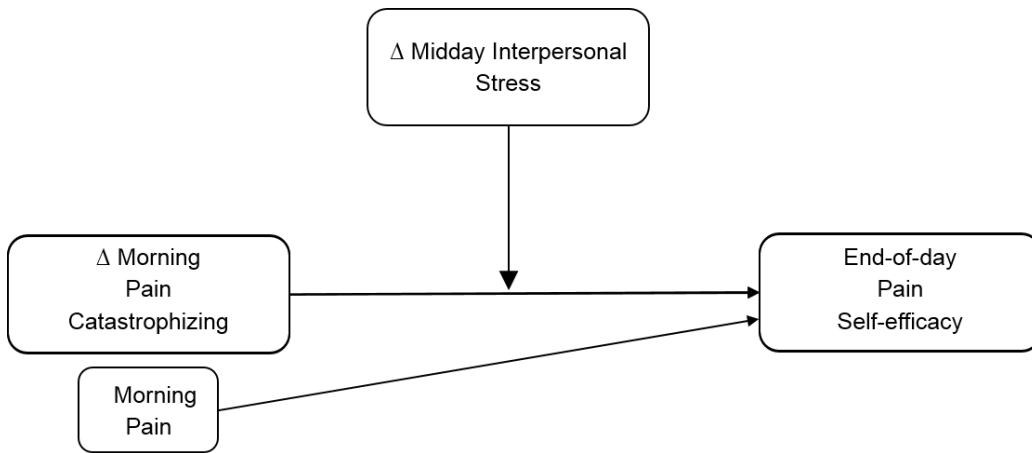


Figure 3. The moderating effect of change in afternoon interpersonal stress on the relation between morning pain-catastrophizing and end-of-day pain self-efficacy, controlling for morning physical pain.

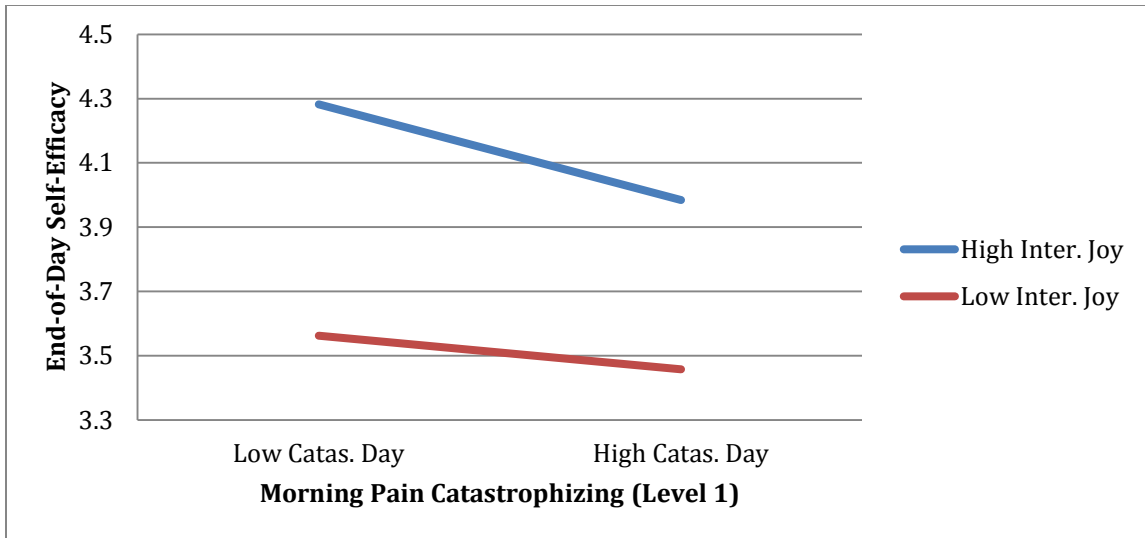


Figure 4. The relation between person-centered catastrophizing in the morning and end-of-day pain self-efficacy was moderated by interpersonal enjoyment at the between-person level. Low interpersonal enjoyment and catastrophizing refers to scores 1 standard deviation below the mean, whereas high interpersonal enjoyment and catastrophizing scores are 1 standard deviation above the mean.

APPENDIX A

MEASURE ITEMS AND RESPONSE SCALE

1. Physical Pain Item: What was your overall level of pain?
Response Scale:
Enter a number between 0 and 100 that best describes your pain level. A zero would mean “no pain” and a one hundred (100) would mean “pain as bad as it can be”. Please enter your answer now. Remember all your answers should be followed by the # key.

2. Pain Catastrophizing Item: You felt your pain was so bad you couldn’t stand it anymore.
Response Scale:
Please enter an answer between 1 and 5 now.
1, is not at all
2, a little
3, some
4, quite a bit, or
5, completely

3. Pain Self-Efficacy Item: If you had a similar pain experience again, how certain are you that you would be able to cope well with its negative aspects?
Response Scale:
Please enter an answer between 1 and 5 now.
1, is not at all
2, a little
3, some
4, quite a bit, or
5, completely

4. Interpersonal Enjoyment (Spouse) Item: During the past 2-3 hours, how enjoyable were your relations with your spouse or partner today?
Response Scale:
Please enter an answer between 1 and 5 now.
1, is not at all
2, a little
3, some
4, quite a bit, or
5, completely

5. Interpersonal Enjoyment (Family) Item: During the past 2-3 hours, how enjoyable were your relations with your family today?
Response Scale:
Please enter an answer between 1 and 5 now.
1, is not at all
2, a little
3, some

- 4, quite a bit, or
5, completely
6. Interpersonal Enjoyment (Friends) Item: During the past 2-3 hours, how enjoyable were your relations with your friends or acquaintances today?
Response Scale:
Please enter an answer between 1 and 5 now.
1, is not at all
2, a little
3, some
4, quite a bit, or
5, completely
7. Interpersonal Enjoyment (Coworkers) Item: During the past 2-3 hours, how enjoyable were your relations with your co-workers today?
Response Scale:
Please enter an answer between 1 and 5 now.
1, is not at all
2, a little
3, some
4, quite a bit, or
5, completely
8. Interpersonal Stress (Spouse) Item: During the past 2-3 hours, how stressful were your relations with your spouse or partner today?
Response Scale:
Please enter an answer between 1 and 5 now.
1, is not at all
2, a little
3, some
4, quite a bit, or
5, completely
9. Interpersonal Stress (Family) Item: During the past 2-3 hours, how stressful were your relations with your family today?
Response Scale:
Please enter an answer between 1 and 5 now.
1, is not at all
2, a little
3, some
4, quite a bit, or
5, completely

10. Interpersonal Stress (Friends) Item: During the past 2-3 hours, how stressful were your relations with your friends or acquaintances today?

Response Scale:

Please enter an answer between 1 and 5 now.

1, is not at all

2, a little

3, some

4, quite a bit, or

5, completely

11. Interpersonal Stress (Coworkers) Item: During the past 2-3 hours, how stressful were your relations with your co-workers today?

Response Scale:

Please enter an answer between 1 and 5 now.

1, is not at all

2, a little

3, some

4, quite a bit, or

5, completely