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THE EFFECTS OF PAIN INTERFERENCE ON EXHAUSTION AT WORK AND THE MEDIATING ROLE OF NEGATIVE AFFECT: A DIARY STUDY OF WORKERS WITH CHRONIC PAIN

by

ZACHARY FRAGOSO

THESIS

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of Wayne State University,

Detroit, Michigan

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(Industrial/Organizational)

Approved by:

_____

Advisor Date

Dedication

I dedicate this work to my amazing and incredibly supportive wife, Melanie Fragoso. Without her support and understanding, completing this project would have been much more difficult, perhaps impossible. I spent countless hours and late nights behind my keyboard and computer screen typing away, and she has been continually supportive. I always thought she was a better student than I ever was or am. Melanie, you are my inspiration.

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CHAPTER 1

INTRODUCTION

Chronic pain, defined as any physical discomfort lasting six months or longer, is prevalent, affecting an estimated 116 million people in the United States (Jensen & Turk, 2014; Turk & Okifuji, 2002). It is also one of the leading causes of work-related disability (Sprigg, Stride, Wall, Holman, & Smith, 2007), contributing to an estimated annual cost of $635 billion in disability compensation, sickness absences, and healthcare costs (Simon, 2012). However, these reports likely underestimate the overall impact of chronic pain on work outcomes as they exclude the psychological impact chronic pain may have on workers' abilities to work effectively. Living everyday life with chronic pain is not only about experiencing pain on daily basis, but is also about managing the pain in the context of everyday activities and routines. Differentiation between the occurrence of a single pain experience and longer lasting pain conditions with a more complex nature is, therefore, one of the challenges in studying pain.

Despite calls for all areas of psychology to explore issues surrounding chronic pain (Jensen & Turk, 2014) there is little research specific to working with chronic pain in the Industrial/Organizational Psychology literature. Exceptions exist (see Byrne & Hochwarter, 2006; Christian, Eisenkraft, & Kapadia, 2015; Ferris, Rogers, Blass, & Hochwarter, 2009; Gangapersad, Brouwer, Kurialsky, Willis, & Shaw, 2010; Hochwarter & Byrne, 2010), yet the majority of these articles fail to consider the dynamic nature of chronic pain and its effects on worker well-being. Workers with chronic pain face daily fluctuations in their pain symptoms, which present unique challenges (Gatchel, Bo Peng, Peters, Fuchs, & Turk, 2007; Patel et al., 2012; Phillips, Carroll, Voaklander, Gross, & Beach, 2012). However, few studies have examined these daily fluctuations in the work environment and the impact of these fluctuations

on worker well-being. In other words, there is much about the ongoing *day-to-day* experience of chronic pain that research at the between-person level of analysis does not capture.

Furthermore, a notable gap still exists in the current I/O literature related to the pain experience. Specifically, the between-person focus of the extant literature ignores the fact that pain fluctuates and thus neglects its dynamic effect on one's work and well-being. It is clear people at work are not always at their best. For workers with chronic pain, the ebbs and flows of negative affect and exhaustion at work can be a response to internal pain experiences. For example, within-person research shows that these somatic complaints are associated with stress and mood outside of work (e.g., Clark and Watson, 1988; DeLongis, Folkman, and Lazarus, 1988; Watson, 1988).

Additionally, pain experiences (i.e. severity) typically studied in the Industrial/Organizational Psychology literature can have debilitating effects on their own, but these effects are short lived as individuals who have experienced chronic pain for a longer time are less affected by the normally debilitating effects of pain (Christian et al., 2015). It has also long been understood that contextual factors contribute to the development, exacerbation, and/or maintenance of chronic pain. Psychosocial stressors, such as family and work-related stress, represent frequently hypothesized factors (Feuerstein, Sult, & Houle, 1985). However, there has been a paucity of research directed at the relationship between pain onset and experiences at work within the I/O literature. Workers with chronic pain face daily fluctuations in experiences of pain that have the potential to interfere with their ability to work effectively, and, in turn, influence their well-being. As such, I focus on one important, yet understudied experience: fluctuations *in pain interference in the work environment* and the effects above and beyond those of fluctuations in pain severity.

The purpose of this study is to build and test a model at the within-individual level that captures and explains differences in employees' day-to-day well-being. In doing so, I contribute to the existing literature by identifying pain interference as an "affective event" that can lead to a negative affective state and psychological exhaustion at work. Moreover, this work integrates the chronic pain and Industrial/Organizational psychology literature by offering theory and data supporting pain interference as a key predictor of exhaustion at work above and beyond pain severity. Furthermore, this paper focuses on one understudied, yet crucial, aspect of the pain experience (i.e. pain interference). In this paper, I will make an argument that pain interference has negative effects above and beyond other aspects of the pain experience, such as severity. In doing so, I will add to the existing literature by demonstrating the importance of pain interference and the mechanisms through which pain interference affects the well-being of workers with chronic pain.

The sections that follow provide a background on the study of pain in psychology. I start with a review of pain experience research, which includes providing a working definition, outlining measurement techniques, and discussing well established antecedents and outcomes. Finally, I will provide theoretical justification for the linkages shown in Figure 1. I begin by more fully describing the integration of theories of physical wellness with Lazarus's (1991, 1999) appraisal model of emotion and the Affective Events Theory (Weiss & Cropanzano, 1996), in the form of the within-individual relationships among pain experiences (i.e. severity), pain interference, and state affect. I then describe the proposed relationship between state negative affect and exhaustion.

Pain Experience

Pain is the most common symptom reported to health care providers, and has a

significant impact on individuals, their loved ones, and society in general. Pain is traditionally dichotomized as acute or chronic. Acute pain serves an adaptive function. For example, as an indicator of potential tissue damage, acute pain alerts the person to attend to the cause of the pain and motivates action to prevent tissue damage, protect the affected body part, and avoid similar damage in the future. Although of interest to some psychologists, such as those working with painful medical procedures, acute pain typically is conceptualized, evaluated, and treated biomedically.

On the other hand, chronic pain, which is defined as lasting at least three months, is more complicated than acute pain. In particular, chronic pain involves a complex set of interactions between neurobiological, psychological, and social factors that can cause pain to be experienced over long periods of time. Furthermore, the adaptive function of acute pain episodes lose efficiency over time, because pain no longer is a reliable indicator of tissue damage, and thus behavioral changes to reduce pain may be maladaptive (Nesse & Ellsworth, 2009). To further complicate the matter, chronic pain is also phasic, and can depend on the psychosocial status of the patient. It may change within hours, days, or weeks; this possibly related to various hormones and their concentrations in the system (Gatchel, Bo Peng, Peters, Fuchs, & Turk, 2007). This results in an unpredictable disease progression that is characterized by chronic pain symptom "flare-ups" and remission periods (Jonsdottir, Aspelund, Jonsdottir, & Gunnarsdottir, 2014). As a result, people with chronic pain are much more likely than those with acute pain to experience psychosocial consequences of pain, such as mood problems, substance abuse, or relationship difficulties (Lumley et al., 2011).

The medical diagnoses associated with chronic pain are inconsistent and evolving. Some types of pain are tied to disease processes in specific tissues, including joint pain (osteoarthritis),

inflammation (e.g., rheumatoid arthritis, inflammatory bowel disease), tumor growth (cancer pain), or damaged nerves (neuropathic pain). There is also a diffuse group of pain problems that have traditionally been classified according to location, such as low back, neck, head, abdomen, pelvis, and chest. This also includes pain presentations that are part of broader multi-symptom syndromes, such as fibromyalgia or irritable bowel syndrome.

My focus going forward will be on chronic pain, because of its pervasiveness, implications in the workplace, and greater relevance than acute pain to psychologists. Yet I will include research on experimentally induced acute pain when such studies are informative. Furthermore, I will attempt to highlight the role of environmental contingencies and emotion in the chronic pain experience, with the understanding that chronic pain is complex, and these are only two of several contributing factors.

Pain experience definition and measurement.

The study of pain in psychology is well represented. In fact, The International Association for the Study of Pain (IASP) has an official journal, PAIN, which publishes original research on the nature, mechanisms, and treatment of pain. The IASP defines pain as ‘‘an unpleasant sensory and emotional experience associated with actual or potential damage, or described in terms of such damage’’ (Merskey & Bogduk, 1994). Explicit in this definition is the idea that pain is partially an emotional experience, but does not require a direct relationship between pain and actual physical damage. Despite the acceptance of this definition by experts in pain research and practice, the role of emotion is still not fully appreciated in more general settings, where pain is often treated as a purely physical experience reflecting underlying tissue damage (Jensen & Turk, 2014).

The focus on the physical symptoms of pain has carried over into self-report measure of

pain experience. Pain experience is often considered a multidimensional construct. These sub-dimensions are meant to capture the physical characteristics of the pain experience, and include frequency, duration, severity, location, spread, and quality (Jonsdottir et al., 2014). Typical self-report measures of pain experience capture two of these dimensions (i.e., severity or intensity and frequency). The Brief Pain Inventory (BPI; Cleeland & Ryan, 1994) contains three questions regarding pain severity and one about the pattern of their pain. Participants rate their pain on a scale from 0 to 10, where 0 indicates no pain and 10 is the worst pain imaginable. Respondents are also asked to answer a question about the pattern of pain, classified as constant pain (pain all the time), daily intermittent (daily pain with one to a few hours break during the day), frequent intermittent (pain most days but pain-free days in between), and periodic (pain-free periods for days or weeks but pain episodes in between). The Pain Quality Assessment Scale (PQAS) also measures pain intensity the temporal pattern of pain (Jensen, Gammaitoni, Olaleye, Oleka, Nalamachu, & Galer, 2006). The fact that pain measures separate pain experience into physical and temporal elements represents an important distinction within the pain literature, yet much of pain research does not distinguish between these sub-dimensions, for an exception see Jonsdottir and colleagues (2014). Furthermore, little is known about the degree to which other aspects of the pain experience, such as pain interference with daily life, affect individuals facing chronic pain above and beyond the physical dimensions of the pain experience.

Antecedents and outcomes of pain experience.

In this section I will discuss the antecedents and outcomes of the pain experience both in general and in the workplace. In the general psychology literature, a strong connection has been made between pain experience and affect as both an antecedent and outcome. Psychologists have long been interested in the potential link between physical wellness and affective experience.

This last decade in particular has witnessed substantial growth in research on pain and emotion. What has emerged are two streams of research focused on neurobiological and psychological links between pain and emotion (Lumley et al., 2011). Much of these new areas of inquiry have focused on the relationship between negative affect and pain. Indeed, several explanations have been proposed to account for the finding that individuals experiencing physical symptoms report higher levels of negative affect.

In a detailed review of the research on the neurobiological link between emotion and pain, Lumley and colleagues (2011) review findings on the processes underlying the physical and the affective components of pain, central sensitization of pain pathways, brain processes linking pain and emotions, and imaging research that highlights the neural basis of emotions and pain. The authors' review points to a complex cyclical interaction between pain and specific emotional states supported by both conscious and unconscious brain functioning. Specifically, research suggests the area of the brain that governs defensive responses is responsible for the subconscious processing of stimuli that underlie emotional states associated with chronic pain. This subconscious, defensive response triggers the conscious experience of fear and anxiety as well as evaluation and rumination about the consequences of pain or injury, including fear of pain (Johnson, Nolen-Hoeksema, Mitchell, & Levin, 2009). On the other hand, conscious brain processes can also either exacerbate or inhibit the defensive response, suggesting that conscious processes can have a reciprocal relationship with physical stimuli. These findings support the notion that pain and emotion are closely connected, which is a key component of the current study.

Lumley et al. (2011) also conceptualize four psychological processes, which are thought to be responsible for the relationship between negative emotions and pain. They include

emotional awareness, expression, and experiencing. Two of which are particularly relevant to the current study (i.e. emotional awareness and experiencing). First, emotional awareness, or being aware of, differentiating, and labeling one's feelings, is an important factor in the chronic pain experience. Research shows that when people experience increased pain, they are less able to distinguish PA from NA, and when they experience increased PA, their NA is less related to their pain (Strand et al., 2006; Zautra, Smith, Affleck, & Tennen, 2001). The dynamic model of affect (Davis, Zautra, & Smith, 2004) proposes a framework for understanding how pain influences the relationship between negative affect (NA) and positive affect (PA). That is, a cyclical relation of pain and NA has been proposed, such that higher levels of stress and pain are associated with increases in NA (Litt, Shafer, & Napolitano, 2004; Zautra, Johnson, & Davis, 2005). In addition, high NA (particularly anger, anxiety, boredom and sadness) was found to be the most important predictor of current and subsequent pain levels, followed by depressive mood (Litt et al., 2004). Zautra and colleagues (2005) conducted a prospective diary study in people with rheumatoid arthritis, osteoarthritis, or fibromyalgia to understand relationships among NA, PA, and pain. They found that weekly elevations of pain and stress predicted increases in negative affect, increases in weekly negative affect and higher average negative affect related to greater levels of pain in subsequent weeks, and both higher weekly positive affect as well as greater positive affect on average resulted in lower negative affect both directly and in interaction with pain and stress. This study highlights the important of emotions as both outcomes and antecedents of pain, yet this study measured pain as a one-dimensional construct (the participants rated their pain on a scale from 0 to 100), failing to address the multifaceted nature of the pain experience and test which aspects of the pain experience are most important in influencing subsequent emotional reactions.

However, the idea that pain is closely related to emotional responses is not completely new. According to the disability hypothesis (Watson & Pennebaker, 1989; Watson, 1988), physical symptoms and health problems cause discomfort, which bring the pain into one's awareness, and in turn lead to negative mood states. The disability hypothesis is unique in that it focuses on state affect. Indeed, this stance is supported by evidence that day-to-day fluctuations in physical problems are associated with changes in affective states (Watson, 1988; Watson & Pennebaker, 1989). Other researchers using daily diary methods also have found that increases in positive affect and decreases in negative affect predict daily pain reductions (Connelly et al., 2007; Paquet, Kergoat, & Dube, 2005).

Secondly, there is increasing evidence that psychological stress or trauma is associated with chronic pain, and likely predisposes to it. One meta-analysis found that childhood abuse and neglect reliably predicted pain in adulthood, and this relationship held when patients with pain were compared with both healthy controls and community non-patients with persistent pain, and even when non-patients with pain were compared with non-patients without pain (Davis, Luecken, & Zautra, 2005). In another example, a workplace study found a four-fold increase in new onset fibromyalgia among workers exposed to workplace bullying, and a two-fold increase among those with high work s and low decision latitude (Kivimaki et al., 2004). Thus, it appears that stressors before pain can trigger or exacerbate pain. However, chronic pain can also increase exposure to stressful events, such as work conflict, marital disruption, and medical procedures and surgeries (Lumley et al., 2011).

As opposed to the general psychology literature, which focuses on the antecedent *and* outcomes of pain experiences, in the organizational sciences, researchers have traditionally focused on the outcome of pain experiences, and comparing the effects of pain severity between

subjects (Ferris et al., 2009; Martocchio, Harrison, & Berkson, 2000). For example, in a sample of working participants, Allen, Hubbard, and Sulivan (2005) found that both productivity and presenteeism decreased with pain severity. In addition to the labor costs related to chronic pain, the I/O literature has found several other workplace-related outcomes associated with pain experience. Chronic pain is associated with increased worker strain (Sprigg et al., 2007), decreased in-role job performance (Byrne & Hochwarter, 2006; van Leeuwen, Blyth, March, Nicholas, & Cousins, 2006), and decreased extra-role work behaviors (e.g., Ferris, Rogers, Blass, & Hochwarter, 2009).

Research has also identified factors that moderate the influence of chronic pain on work outcomes. For example, Byrne and Hochwarter (2006) found that perceived organizational support mitigates the adverse effects of pain experiences on performance-related outcomes (i.e., effectiveness, work intensity, citizenship behavior, and task performance). Further, Hochwarter and Byrne (2010) reported that perfectionism and guilt together moderated the relationship between pain experiences and both job satisfaction and job tension (the relationships were strongest when both perfectionism and work-induced guilt were simultaneously high). Additionally, one study taking a within-person approach on the workplace consequences of somatic complaints has found that found that somatic complaints affect withdrawal and extra-role behaviors by reducing job resources and work engagement (Christian et al., 2015).

Pain Interference

In a special issue of the *American Psychologist* on chronic pain, Jensen and Turk (2014) highlighted the important contributions the field of psychology has made to the understanding and treatment of chronic pain. Prior to the 1960s, the medical field viewed chronic pain as primarily a medical issue that required a physical treatment alone (e.g., medication, surgery). It

was around this time that psychologists began applying psychological principles to help understand and treat people with chronic pain. There was a paradigm shift away from viewing chronic pain from a purely medical perspective to understanding it as having biological, psychological, and social elements.

Today, empirical findings continue to support the idea that a combination of physiological, psychological, social, cultural and behavioral factors influences the experience of chronic pain (Okifuji, Karppinen, Sipilä, Suutama, & Piirainen, 2015). In a recent qualitative study, researchers found that it was not the physical pain itself but the psychosocial consequences, such as distress, loneliness, lost identity, reduced ability, and low quality of life that mattered most to individuals with chronic pain (Okifuji et al., 2015). Therefore, when examining the effects of chronic pain, it is important to include not only the sensory ratings of pain, but also the meaning of the pain experience for the individual within a specific context. In this study, I seek to investigate the effects of chronic pain in the context of work. Specifically, I argue for that pain interference is key predictor of work-related well-being, above and beyond the sensory experiences of pain severity. Positioning pain interference as central to the experience of chronic pain in the workplace requires an understanding of its definition and measurement, and how it has been studied in the past.

Pain interference research has been both experimental and correlational in nature. For example, several experimental studies in the pain literature have investigated the interruptive effect of pain on people's task performance. Many of these studies support the idea that performance on a cognitive task is hindered by the simultaneous presence of pain (Buhle & Wager, 2010; Crombez, Eccleston, Baeyens, & Eelen, 1996, 1997, 1998; Richardson et al., 2010). In this section, I will provide a review of how pain interference has been historically

studied in experimental settings and discuss measurement of pain interference and the antecedents and outcomes of pain interference.

Many experimental studies of pain interference follow a similar primary task experimental protocol designed to measure the attentional degradation of pain (e.g., Crombez et al., 1996, 1997; Eccleston, 1994, 1995). Under this protocol, subjects have to ignore pain in order to effectively perform a cognitive task. Eccleston (1994) and Eccleston (1995) used this protocol with chronic pain patients. He showed that patients in the pain condition performed worse on tasks requiring attention, relative to patients in low pain and no-pain controls. Crombez et al. (1994) also used a similar primary task protocol, where healthy volunteers were required to discriminate as quickly as possible between noises of long or short duration. They found performance on the discrimination task was severely affected by pain.

In another example, Crombez and colleagues (1996) hypothesized that the strength of attentional interference would subside with repeated presentations of pain. In their study, healthy volunteers again performed a tone discrimination task in the presence of two types of distractors, which they were instructed to ignore (i.e. an electrical pain stimulus and a control stimulus). The researchers found evidence for the habituation of the task interference during the early processing of both the pain and the control stimulus. However, it was also found that the attentional interference during pain did not completely disappear with repeated presentations. Finally, results clearly showed a performance decrement in the pain condition, such that processing time of the tones during pain trials was greater than during control trials.

Pain interference definition and measurement.

From these studies, research has emerged that focuses on the construct of pain interference. As opposed to pain severity which focuses on the quality and frequencies of pain,

pain interference refers to the degree to which functional ability is impaired in patients with a chronic painful condition. Because it is difficult to measure objectively, as in the aforementioned experimental studies, subjective measurement of pain interference has received significant attention (Chow et al., 2010; Cook, Schalet, Kallen, Rutsohn, & Cella, 2015; Crins, Roorda, Smits, de Vet, Westhovens, & Cella, 2015; Holmström, Kemani, Kanstrup, & Wicksell, 2015; Krebs et al., 2009). Measures that may be used to assess pain interference include the Brief Pain Inventory (BPI) Interference scale (Chow et al., 2010), the NIH Patient-Reported Outcome Measurement Information System (PROMIS) Pain Interference (PROMIS-PI) metric (Cook et al., 2015), the Pain Interference Index (PII; Holmstrom et al., 2015), the Pain Disability Assessment Scale (PDAS; Yamashiro et al., 2011), the Multidimensional Pain Inventory (Kerns, Turk, & Rudy, 1985). Many of these measures are multidimensional, including interferences in different domains, such as physical activity, activities of daily living, and social relations. The time anchor can also vary depending upon the assessment instrument (Broderick, Schneider, Schwartz, & Stone, 2010). For example, the Brief Fatigue Inventory (BFI; Mendoza et al., 1999) asks about interference during the past 24 h, the Brief Pain Inventory (BPI) asks about interference during the last week, and the Multidimensional Pain Inventory does not specify a reporting period.

The Brief Pain Inventory (BPI) Interference scale is perhaps the most frequently used measure. It has the strengths of focusing only on pain interference and being brief, five items total. However, even though one previous study using factor analytic procedures identified two pain interference dimensions (i.e. activities interference and a social/emotional interference; Cleeland & Ryan, 1994), the BPI Interference scale is usually scored to assess a single global interference domain, which limits the ability of researchers to assess the different life activity

areas affected by pain (Yamashiro, Arimura, Iwaki, Jensen, Kubo, & Hosoi, 2011). The emergence of pain interference as a construct and advances in measurement started a new wave of research in the area. Instead of focusing on pain experience as one-dimensional with an emphasis on the severity of pain, research has begun to focus on more nuanced aspects of the pain experience. Yet more research is needed to parse the effects of the difference elements of the pain experience on important outcomes.

In the current study, I differentiated pain severity, the most commonly studied aspect of the pain experience, from pain interference. Pain severity refers to the magnitude of pain, while pain interference refers to pain's impact on activities (Collins et al., 2005). Although pain interference with work appears to increase with pain frequency (Allen, Hubbard, & Sullivan, 2005), and mediate the relationship between pain severity and absenteeism (Murry et al., 2013), a clear understanding of the relationships between pain interference with work, affect, and employee well-being is lacking. I addressed this gap, investigating the relationships among interference in the work environment, negative affect, and end-of-day exhaustion.

Antecedents of pain interference.

Several recent studies have examined physiological and/or environmental antecedents of pain interference. For example, in a cross-sectional survey of chronic orofacial pain patients, Boggero and colleagues (2015) found that pain intensity is positively related to pain interference and is moderated by age such that older patients experienced less interference. In another example, Mendoza, Gertz, and Jensen (2014) examined four characteristics of pain (i.e. intensity, quality, spatial and temporal characteristics) and their relationships with pain interference. Their findings confirmed the significant association between pain intensity and measures of pain interference and psychological functioning; however, none of the other domains showed

statistically significant associations with pain interference.

Finally, a cross-sectional study of interference of low back pain on physical functions in care workers examined the influencing factors of the interference, such as workers' demographic, lifestyle habits, self-reported health status, working conditions and previous pain experience (Lin et al., 2014). In this study, weekly working days, average daily working hours, fixed job duties, and lack of break time during work had a significant positive correlation with self-reported, global pain interference.

Individual differences, emotional response to pain, and coping can also influence pain interference. In a study of participants with rheumatoid arthritis, Ryan and McGuire (2015) found that individual perceptions of their own autonomy, relatedness, and competence were negatively related to pain interference. In a cross-sectional survey study of multiple sclerosis patients, felt distress, negative beliefs about pain and its consequences, and avoidance of activity were all positively related to pain interference (Harrison, Silber, McCracken, & Moss-Morris, 2015). In another example, psychological flexibility and pain catastrophizing mediated the baseline to three-month follow-up changes in pain interference in a randomized controlled trial on internet-based Acceptance & Commitment Therapy (ACT) design for patients with chronic pain (Trompetter, Bohlmeijer, Fox, & Schreurs, 2015).

The aforementioned studies highlight an evolution of pain interference research. The investigation of pain interference has moved from experimental environments in which attention is directed toward or away from a primary task, and pain interference is measured in terms of reduced speed and accuracy, to multidimensional self-report measures.

Outcomes of pain interference.

There is a lack of studies in the existing literature that examine outcomes of pain

interference. Among other important factors is the complex relationship between the temporal characteristics of pain, pain interference, and their impact on peoples' lives. Indeed, patients with chronic pain can experience a range of symptoms to varying degrees and with varying impact on their lives. Surely, stress is induced when the experience of pain directly conflicts with an individual's desired state that is not captured in experimental studies. Previous studies have focused the antecedents of pain interference, but ignore the emotional consequence of pain interference that could also hinder one's ability to function effectively in certain environments, such as work.

However, one study addresses these issues by examining pain interference and anger at the within-individual level (Burns et al., 2015). In this study, married couples (one spouse with chronic low back pain) completed electronic daily diaries, with assessments five times a day for two weeks. Increases in state anger were related to their reports of concurrent increases in pain and pain interference and to spouse reports of their partner's pain behavior. However, when patient-reported pain interference was used as an independent variable to predict state anger three hours later, no lagged effects were found, suggesting that pain interference does not affect subsequent increases in anger. These finding are informative, but two potential issues arise from this study. First, to be included in the study, participants must have pain of the lower back stemming from degenerative disk disease, spinal stenosis, disk herniation, or chronic myofascial pain. Furthermore, patients were excluded from this study if their pain was due to a chronic illness (i.e. rheumatoid arthritis, migraine or tension headache, fibromyalgia), yet individuals with chronic illness represent largest diversity groups in the U.S. workforce (Houtenville & Ruiz 2011), thus the generalizability of this study to a larger working population may be questioned. Second, this study only included the physical limitation dimension of pain interference, such as,

"To what degree did your pain interfere with you being physically active?" and, "How much did you rest (sit, lie down) because of your pain?" Ignoring social aspects of the pain interference construct (e.g. impact on interactions with customers or coworkers), equates to only looking at half the experience of chronic pain in the workplace (Chow et al., 2010, Jensen & Turk, 2014, Lumley et al., 2011).

Current Study

As mentioned, I focus on one important yet understudied pain-related experience in this study: *pain interference in the work environment*. Within the workplace, the experience of pain may cause interference by inhibiting an individual's ability to do activities that are required to do the job well including, for instance, displaying positive affect, communicating well with coworkers, and completing tasks that are cognitively or physically demanding. Specifically, I posit that fluctuations in pain-related interference at work mid-day will predict fluctuations negative affect mid-day and end-of-day emotional exhaustion.

In sum, I have concluded that: 1) chronic pain is a complex and dynamic phenomenon that has both physiological and psychological components; 2) experiences of chronic pain can increase exposure to stressful events, such as interference with one's ability to do activities required by the job; and 3) chronic pain experiences are generally associated with negative affect; yet 4) research on the emotional processes involved with pain *interference* is lacking, particularly in the work context. In the following sections, I will outline the theoretical background and propose hypotheses for the current study.

Theory.

Before moving on, I will discuss the stressor and strain perspective employed as it relates to the current study. *Stressors* are conditions that are appraised by an individual as harmful or

threatening (Spector & Jex, 1998). Thus, I will adopt the following definition of work stress, "The process by which workplace psychological experiences and demands (stressors) produce both short-term (strains) and long-term changes in mental and physical health" (Ganster & Rosen, 2013, p. 4). Environmental events that trigger these processes are commonly referred to as *stressors*, while the individual's responses are generally called *strains* (Ganster & Rosen, 2013). Furthermore, in the work stress literature, environmental stressors typically refer to *psychosocial stressors*, or work characteristics that affect individuals through a psychological stress process, as opposed to a directly physical one. For example, performing physically strenuous and/or pain-inducing tasks that lead to the development and/or maintenance of somatic pain complaints (i.e. strains) would be considered physical stressors. However, the experience of pain interference and subsequent affect response would be considered a psychological stressor.

Research has shown that stressors are detrimental not only to indicators of psychological well-being, such as mood, but also to somatic complaints (e.g., Frese, 1985; Spector & Jex, 1998). Among others, the stress response is characterized by the activation of the sympathetic–adrenal medullar system, including increased heart rate, blood pressure, and catecholamine secretion. Over time, such reactions can result in the experience of somatic complaints, such as headache, back pain, and gastrointestinal problems (Ganster & Rosen, 2013). Indeed, several studies have successfully identified potential environmental antecedents of somatic complaints (e.g., Potter, Hartman, & Ward, 2009; Meier, Gross, Spector, & Semmer, 2013). On the other hand, pain interference when experienced in the workplace can be a source of stress in and of itself. In other words, pain experience in the workplace can be seen as strain, but also a stressor when appraised by an individual as conflicting with one's ability to perform their job. This appraisal process includes not only the somatic experiences of pain (e.g. frequency and severity),

but what it means for an individual in the workplace. I argue that the appraisal of pain experiences in the workplace will negatively impact psychological well-being when it is seen as conflicting with work demands.

Study of similar work/non-work conflict is burgeoning in the organizational psychology literature. This research is grounded in inter-role conflict theory. This theory posits that conflict arises when pressure to perform one role impedes the performance of another (Carlson, Kacmar, & Williams, 2000; Greenhaus & Buetell, 1985). In other words, inter-role conflict is when a role an individual performs in one domain (e.g., home) interferes or conflicts with another role (e.g., work) of the individual. Although chronic pain itself is not a role, it may directly conflict with a person's ability to complete tasks associated with the roles they hold and result in similar strain outcomes experienced by those facing role conflict. Thus, role conflict research, specifically work-related conflict, provides a context for thinking about pain interference in the workplace and helps frame and inform the current study about possible outcomes.

For example, conflict between work and family roles is referred to as work-family conflict, which has benefited from extensive research in the organizational psychology literature (Carlson et al., 2000; Greenhaus & Buetell, 1985). Research on the work/non-work interference has tended to assume that there is a relatively stable pattern to people's lives that cause conflict and lead to negative performance and well-being related outcomes (Grzywacz, Butler, & Almeida, 2009). Indeed, there is evidence to support the existence of these stable routines (Moen & Wethington, 1992; Morehead, 2001). As such, interventions that incorporate adaptive strategies to minimize work/non-work interference have been developed (Moen and Wethington, 1992).

On the other hand, there may be unexpected or unpredictable events in people's lives that

are likely to have effects on their well-being. Grzywacz, Frone, Brewer, and Kovner (2006) found that 52% of respondents reported experiencing fluctuations in family work conflict. Additionally, a 14-day diary study found that 62% of total variation in work-family conflict and 63% of the total variation in job demands was explained by within-person variation over time (Butler, Grzywacz, Bass, & Linney, 2005).

Similarly, chronic pain is also phasic, characterized by chronic pain symptom "flare-ups" and remission periods. Pain severity may change within hours, days, or weeks, and this has been shown to be related to fluctuations in pain interference (Allen, Hubbard, & Sullivan, 2005; Gatchel, Bo Peng, Peters, Fuchs, & Turk, 2007). Thus, although people may have stable patterns to their lives, variations in the factors that affect the work/non-work interface may particularly affect their well-being precisely because they are deviations from this pattern.

Thus, the current study attempts to separate the stable or routine elements from the fluctuating elements of people's pain and pain interference in order to better understand the effects of chronic pain on well-being in the workplace. To do this, I propose the use of diary study methodology to examine fluctuations in pain and pain interference on a daily basis. Event and time sampling techniques, such as experience sampling methodology (ESM) and diaries, are particularly relevant to the study of primary outcomes associated with work stress because these measures allow researchers to capture short-term within- person outcomes, such as emotions and transient behaviors (Beal, 2015).

Additionally, the current study proposes a stress process by which pain interference initiates a series of cognitive and physiological reactions resulting in a negative affective response, and ultimately reduced well-being. In the following section, I will draw from several different stress theories and propose the study hypotheses.

Pain inference, appraisal, and affect.

In the current study, I seek to study the stress appraisal process that arises when pain is experienced in the workplace and the subsequent affective response. Whereas some pain experiences, such as pain severity, are perceived on a moment-to-moment basis, this is probably not the case for interference with functioning, which naturally involves cognitive inference and judgment. Stress is not just the result of the physical experience of pain, but the appraisal of the pain within a given context. For this reason, I seek to study the effects of pain interference in the workplace above and beyond the experience of physical pain. Determining whether one's activities have been limited may be assessed across time as one tries to make plans and to engage in them. To support my position, I will provide a brief discussion of both Lazarus' transactional model and Weiss and Cropanzano's affective events theory, which provide insight into the role of appraisal and emotion in the stress process.

According to Lazarus's (1991, 1999) transactional, or cognitive, theory of emotion, affective states arise from the way people appraise what is happening with respect to their well-being and the way they cope with it. Lazarus argues that in the face of stressors two appraisals take place. First, an individual's primary appraisal refers to whether or not the encounter has motivational relevance, or whether an individual has personal stake in the given situation. Motivational relevance is determined by an appraisal of whether progress toward one's goals is facilitated or hindered. A stake in an encounter generates the potential for an emotional response, with positive affect stemming from appraisals of goal progress and negative affect stemming from appraisals of goal impediment. Furthermore, encounters that are highly motivationally relevant and are appraised as involving harm/loss, threat, or challenge to the individual's well-being are considered stressors (Lazarus, 1994).

Second, the outcome of this initial appraisal process influences emotions, which in turn influence a secondary appraisal, or how a person copes with stressors. The transactional model proposes that if individuals determine that they have a stake in the encounter, they will engage in a secondary appraisal in an attempt to change conditions that that they believe are the source of stress. The goal of secondary appraisal is again to mobilize available coping options to address the perceived harm, threat, or challenge. Individuals tend to base their coping strategy on their appraisal of whether something can be done to change the situation (Folkman and Lazarus, 1985). For example, in situations appraised as unchangeable, emotion-focused coping is expected to be used (Folkman & Lazarus, 1980). This is particularly relevant in the case of workers with chronic pain who face unpredictable and uncontrollable fluctuations in chronic pain and pain interference.

Another fundamental proposition of the transactional model is that it is the interaction of the person and environment that influences the primary stress appraisal. In the workplace, employees are hired to perform specific duties or provide services which are packaged into a job (Ristau, 1983). However, performance of these duties is often influenced by external factors that are independent of behavior and outside of the person's control, chronic pain fluctuations for example. These external factors are called disturbances (Carver & Scheier, 1998). Again, it is important that the study of chronic pain as a source of stress include not only the severity of pain, but its interaction with a given environment, such as the workplace. Indeed, the effects of somatic pain experiences diminish over time as individuals habituate to the negative effects of the physical aspects of pain (Christian, Eisenkraft, & Kapadia, 2015). Yet, the psychosocial consequences of pain in the workplace, such as pain interference with one's ability to complete their job duties and/or socialize effectively with others in the workplace, are likely to continue to

have detrimental effects on well-being above and beyond somatic pain experiences (i.e. severity) as they are continually appraised as threating based on the context. Thus, it is critical to understand the process through which these disturbances affect subsequent behavior. That is, after external forces impede or facilitate goal progress, how does this change worker affect and well-being?

As a result of this appraisal process, affective states arise in form of emotions, which recent studies have shown to be important aspects of the work experience that influence critical job outcomes (Weiss and Cropanzano, 1996). The affective events theory (AET) posits that specific work events are antecedents of affective reactions and behaviors (Weiss & Cropanzano, 1996). Within this theoretical framework, work events are defined as something that occurs in a work setting during a particular period that brings about a change in what one is experiencing and feeling. Affective events, in turn, have direct and indirect effects on employee behavior. For example, in a study of computer software programmers, significant work events had direct effects on negative emotional reactions, which in turn related to counter productive work behaviors (Matta, Erol-Korkmaz, Johnson, & Bıçaksız, 2014). In this study, participants reported a variety of different work events that became the referent for their subsequent survey responses. These affective events were coded into five broad categories (i.e. task-relevant work events, relations with the supervisor, relations with coworkers, relations with subordinates, and organizational policies). This study supports the idea that a wide variety of different events may lead to affective reactions in the workplace. However, little is known about specific experiences, or events, that workers with chronic illness have on a daily basis that may lead to these affective reactions.

Taken together, appraisal theory and affect events theory support the assertion that chronic pain interference in the work environment leads to an affective response. Furthermore, I posit that the effects of pain interference on subsequent negative affectivity will remain while controlling for other typically studied aspects of the pain experience (i.e. severity).

H1: Fluctuations in daily pain interference in the workplace mid-day are positively related to fluctuations in negative affect mid-day, while controlling for fluctuations in pain severity.

Affect and well-being in the workplace.

Organizational settings are emotionally complex environments where employees must manage the emotions they exhibit to others, including supervisors, subordinates, coworkers, and customers (Barsade & Gibson, 2007). In fact, the concept of workplace burnout was first conceptualized as a result of the emotional demands associated with service work (Maslach, Schaufeli, & Leiter, 2001). The role of emotion in the workplace will continue to grow as the U.S. economy trends from manufacturing to a service economy which requires frequent customer interaction. With the expansion of the service industry and the growing number of workers with chronic illness and pain, the study of the workers facing both pain interference and emotional demands is of increasing importance. The current study seeks to further examine this phenomenon.

Regulating emotions in the workplace is a difficult and stressful behavior (Beal, Trougakos, Weiss, & Green, 206). Theories of human self-regulation suggest a range of proximal psychological mechanisms associated with fluctuations in depletion and feelings of exhaustion that are detrimental to individual well-being (e.g., ego-depletion theory; Baumeister, Bratslavsky, Muraven, & Tice, 1998). For example, those working in service industries can

experience negative outcomes associated with having to manage their emotions to fit certain display rules required by their job (i.e., emotional labor; Ashforth, & Humphrey, 1993).

This is particularly important when studying chronic pain interference in the workplace as individuals devote emotional and cognitive resources when facing health limitations, typically by redirecting attention, suppressing ruminative thoughts about the experience, and regulating affective states based on requirements of the job (Eccleston & Crombez, 1999). As such, an experience of pain interference may deplete the stock of potential energy that could otherwise be used in future cognitive, emotional, and behavioral tasks and the psychological well-being of the individual. In line with the extant pain literature, cognitive theories of stress, AET and self-regulation theories, I propose that negative affect leads to exhaustion. Further, I test this model with a sample of workers with chronic pain working in the service industry who have regular interaction with customers.

H2: Fluctuations in negative affect mid-day are positively related to fluctuations in end-of-workday emotional exhaustion while controlling for fluctuations in pain severity.

Further, it is well-known from within-person studies of workplace behaviors that individuals' affective reactions to external stimuli play integral roles in their subsequent attitudes and behaviors (e.g., Beal et al., 2005; Ilies, Scott, & Judge, 2006). Thus, it is reasonable to expect that pain interference, via its effects on affect, would relate to important outcomes for workers with chronic pain. Furthermore, based on the appraisal model of stress and affective events theory, I posit that the direct effect of pain interference on emotional exhaustion will be non-significant when negative affect is included in the model. That is, I propose full, rather than partial, mediation based on the aforementioned theory that posit stress response is a result of subjective appraisal, as opposed to objective stressors. Thus, without the subjective appraisal of a

stress event as threating and subsequent negative affective response, the actual stressor should not directly lead to negative outcomes, such as emotional exhaustion.

H3: Pain interference in the workplace mid-day is indirectly related to end-of-day exhaustion through its influence on negative affect while controlling for pain severity (negative affect fully mediates the relation between pain interference mid-day and emotional exhaustion end-of-day).

Moderators.

Conservation of resources theory suggests that stress appraisal arises from perceived threat to their resources (e.g. time, money, and energy; Hobfoll, 1989). Indeed, in the service industry work environment, as in this sample, pain interference, pain severity, and negative affect can be seen as threats to resources. According to this theory, individuals will experience strain and engage in withdrawal behaviors as a result of this threat when they do not have the personal resources to address the stressor, or invest in further resources when adequate resources are present. Thus, in the presence of additional work-related resources, the relationship between negative affect and emotional exhaustion should be weaker. Social support is a promising moderator variable as it has been shown to be an important variable in the chronic pain literature (Cano, 2004). For example, Cano (2004) found that, in a sample of married chronic pain patients, pain catastrophizing was negatively related to perceptions of social support from others. Additionally, social support originating from relationships within the workplace (i.e. supervisor and coworker support) have been shown to moderate the effects of the workplace stressors on strain (Viswesvaran, Sanchez, & Fisher, 1999). Thus, in addition to the hypotheses included in this study, I will address the follow research question.

Research Question: Does between-individual social support moderate any of the paths included in the model?

CHAPTER 2

METHOD

Participants and Procedures

Archival data was used to test the aforementioned hypotheses. Participants from a previous study on chronic pain who were working full-time and indicated a willingness to participate in future studies were contacted via email (n = 25). Additionally, faculty and staff from a large Midwestern University who were working full-time and experienced chronic pain were recruited with a message posted on the University's intranet (n = 26). Additionally, participants were recruited from the Spondylitis Association of American (n = 35). Participants were required to have chronic pain and work at least 40 hours a week in a job that requires customer interaction.

Participants (N = 86) were prompted by email to completed two online surveys per day for five consecutive workdays (Monday-Friday), resulting in N = 860 measurement occasions. The first survey was completed in the middle of participants' work day between 11:30am and 1:30pm and the second was completed at the end of participants' work day between 3:30pm and 6:30pm (all times were local time in the respondents' respective time zones). Participants received incentives ranging from $13.50 to $75, depending on how many surveys they completed (83% completed 9 of 10 and 94% completed at least 7 of 10 surveys). Full information maximum likelihood (FIML) method was used to handle missing data. This method has been shown to outperform traditional pairwise and listwise deletion methods (Enders & Bandalos, 2001). Participants were, on average, 38 years of age (SD = 10.94). The sample was 85 percent female, and averaged 8 years of tenure with their current employer (SD = 6.89).

Measures

All measures were collected via online daily diary surveys (two surveys per day). Data on pain interference, pain severity, and negative affect was collected in the first daily survey and the data on exhaustion was collected in the second daily survey, as illustrated in Table 1. However, pain severity and negative affect were measured at both time points. The first daily measurements of pain severity and negative affect were used in subsequent analyses because I believe that pain severity should theoretically proceed emotional exhaustion, and temporally separating measurement occasions of predictors and outcomes has the potential to reduce the threat of common method variance (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003). All scale reliabilities (i.e. Cronbach's alpha) exceeded .70 (see *Table 2)*. Because this study involved repeated surveys, shortened measures were used to reduce the chances of participants experiencing survey fatigue (see Rogelberg, & Stanton, 2007).

Pain Severity. One item from Cleeland and Ryan's (1994) Brief Pain Inventory was used to measure pain severity. Participants were asked to rate their level of pain, "Right now," on a scale from (0) no pain to (10) pain as bad as you can imagine. Please see Appendix A.

Pain Interference. Five items from Cleeland and Ryan's (1994) Brief Pain Inventory were used to measure pain interference. Respondents were asked "So far today, how much has pain has interfered with your… (e.g., normal work)." The response scale ranged from (0) not at all to (10) completely interfered. Please see Appendix A.

Negative Affect. Six items from Watson and colleagues' Brief Measures of Positive and Negative Affect were used to assess negative affect. Participants were asked, "Right now, to what degree do you feel … (e.g., distressed)." The response scale ranged from (1) not at all to (5) very much. Please see Appendix B.

Emotional Exhaustion. Five items were used from Whorton's (1993) study of service work and managing emotions. Participants were asked to "Please indicate how much the following is true for you right now" (e.g., "I feel emotionally drained from my work"). The response scale ranged from (1) not at all to (5) very much. Please see Appendix C.

Coworker Support. Three items were used from a measure of perceived work characteristics (Haynes, Wall, Bolden, Stride, & Rick, 1999). Participants were asked, "Please indicate how much you agree or disagree with each of the following statements." Example items include, "My coworkers listen to me when I need to talk about work-related problems," and, "My coworkers help me with difficult tasks." The response scale ranged from (1) strongly disagree to (5) strongly agree. Please see Appendix D.

Supervisor Support. Four items were taken from a measure of perceived supervisor support (Eisenberger, Stinglhamber, Vandenberghe, Sucharski, & Rhoades, 2002). Participants were asked, "Please indicate how much you agree or disagree with each of the following statements." Example items include, "My supervisor is helpful to me in getting the job done," and, "My supervisor is willing to extend himself/herself to help me perform my job." The response scale ranged from (1) strongly disagree to (5) strongly agree. Please see Appendix E.

CHAPTER 3

ANALYSIS

Within-individual approaches are critical to the study of emotions because emotions are elicited by a specific cause and are short lived (Barrett, 2006). Further, estimating the direct effects of pain interference with work on exhaustion and indirect effects through negative affect with a single level mediation analysis would ignore the dynamic nature of these variables. A multilevel approach allows for the estimation of individual-level data considering both context and individual-level effects at work simultaneously by "deconflating" individual and contextual effects that otherwise might be mistaken for each other (Preacher, Zyphur, & Zhang, 2010). Therefore, I took a multilevel approach in the study in order to capture variance both between and within subjects over time. This model allows the effect of pain interference on negative affect and exhaustion to differ within individuals, while also allowing accounting for between-individual differences.

To handle missing data, raw maximum likelihood, also known as Full Information Maximum Likelihood (FIML), methods were implemented which use all available data points in a database to construct the best possible first and second order moment estimates under the missing at random (MAR) assumption. Mplus features this missing data option that has been shown to outperform the default listwise deletion method (Enders & Bandalos, 2001).

To test the within-person mediation hypotheses, I examined a 1-1-1 path model with all random slopes using Mplus 7.4. This is the most flexible multilevel mediation model with all variables measured at level-1 and all causal paths allowed to vary between level 2 units (i.e., random slopes). However, before testing this model, I calculated measures of agreement for each variable in the model to ensure there was adequate variance at the within-individual level (ICC 1

estimates are presented in Table 2; Bliese, & Halverson, 1998; Heck & Thomas, 2015). Next, I conducted a model comparison to determine if the fixed or random intercepts model fits the data better. Then, I tested a random slopes model to determine the relationships between variables of interest. Then, I estimated the average of each of these random effects, as well as their variability (Zhang, Zypher, & Preacher, 2009). The average of the random slopes for paths *a* and *b* are then multiplied together to create a product term and determine if an indirect effect exists. To test the statistical significance of the indirect effect a bootstrap method was used based on resampling with replacement. From each of these samples the indirect effect is computed and a sampling distribution is empirically generated. With the distribution, a confidence interval is calculated to determine whether the indirect effects are statistically significant from zero.

When there are differences between level 2 units on predictors in a model, quantification of lower-level (level 1) effects contain a level 2 component. Following the suggestions of Zhang et al. (2009), I centered variables measured at the daily level (level 1) around each person's mean (level 2). Mean centering pain interference, pain severity, and negative affect within level 2 (individual-level) removes the level 1 (day-level) effects from their level 2 components (see Zhang et al., 2009). By mean centering these variables within the individual, individual means are set equal to zero, and daily measurements are deviations from that individual mean of zero, which can be either positive or negative indicating directionality of the change. This allowed me to examine the relationship between fluctuations from individual averages in outcomes and predictors, as opposed to absolute values.

Using this within-individual framework as a foundation, this study tested the model shown in Figure 1. In this model, daily fluctuation in pain interference mid-day at work is related to negative affect mid-day, which, in turn, contributes to end-of-day worker exhaustion while

controlling for daily pain severity. This method allowed me to model within-individual changes in affective reactions while removing the confounding effects of between-individual variation (e.g., Burke, Brief, & George, 1993; Watson & Pennebaker, 1989). Furthermore, I statistically controlled for pain severity in the model by treating it as an additional predictor of the pain interference negative affect slope and also when testing the direct effects of pain interference on exhaustion.

Finally, additional analyses were conducted to determine if moderators exist in the data. The goal of these analyses was to determine if factors at the between-individual level (i.e. supervisor and coworker support) would impact the relationships in the model. First, a random effects model was conducted to determine if statistically significant, between-individual variation exists between random slopes. If significant variance is found, in accordance with Edwards and Lambert (2007), the interactions were tested by regressing the level two moderator variables onto the vector of random slopes encompassing a given path.

CHAPTER 4

RESULTS

Following the steps of testing multilevel models outlined by both Bliese and Halverson (1998) and Heck and Thomas (2015), I started by calculating intraclass correlation coefficients for each variable in the model. Specifically, I calculated ICC(1) which reflects the total variance in intercepts explained by group membership (Bliese & Halverson, 1998). Murphy, Myors, and Wolach (2014) encourage researchers to adopt traditional conventions used when interpreting effect sizes of ICC(1) values. Specifically, a value of .01 can be considered a "small" effect, a value of .10 can be considered a "medium" effect, and a value of .25 can be considered a "large" effect. As indicated by the ICC(1) values (Pain interference, .66, $p < .01$, Negative Affect, .58, $p < .01$, Emotional exhaustion, .41, $p < .01$, Pain severity, .69, $p < .01$; values also reported in Table 2), all variables in the model have a large amount of variance accounted for at the between-individual level; however, there remains a large amount of variance that is also due to within-individual variation in intercepts, which is of interest in the current study. Thus, these findings warrant taking a multilevel approach, which accounts for between-individual variance in both slopes and intercepts when estimating within-individual effects.

In Mplus the standard robust chi-square for testing nested models can be computed in two different ways, using the test of fit, or using the log-likelihood. The two have been shown to lead to similar results (Hayes, 2006; Satorra, & Bentler, 2010). However, one of the advantages of the log-likelihood approach is that it does not require the existence of a test of fit, which cannot be obtained via the MLR estimator in Mplus, and it can be used for any pair of nested models. The likelihood ratio test is conducted by comparing the ‘‘deviances’’ of two models, one in which the

effect of interest is fixed and another in which it is allowed to vary randomly across level-2 units. In this case, the slopes are set to fixed. In the model with random slopes, -2 Logliklihood = -720.79. Without the random slopes, -2 Logliklihood = -817.32, a difference of 96.53. These two models differ by three parameters estimates, the slope variance of pain interference, pain severity, and negative affect. As a result, the difference in the deviances is distributed as chi-squared with three degrees of freedom under the null hypothesis that the variance of the random slopes component is zero. For $X^2(3) = 96.53$, the p-value is less than .001, leading a rejection of this null hypothesis.

Next, I will report the findings of the 1-1-1 random slopes model. Hypothesis 1 is supported; on average, individuals who experienced pain interference with work mid-day reported higher levels of negative affect mid-day ($a' = .40$, $p < 0.01$), and there was no evidence that this effect differed between individuals, ($V_{a'j} = .03$, $p = .34$), while controlling for the effect of pain severity on negative affect ($e' = .03$, $p = .36$).

Hypothesis 2 is supported; on average, individuals who reported higher levels of negative affect mid-day reported higher levels of exhaustion end-of-day, ($b' = .35$, $p < 0.01$), and this relationship varied between individuals, ($V_{b'j} = .23$, $p < 0.01$), while controlling for the effects of pain severity on emotional exhaustion ($f' = .01$, $p = .15$), suggesting that predictors of this variation may exist (i.e. moderators).

Finally, a formal test of the indirect effect revealed a statistically significant indirect effect of pain interference on exhaustion through negative affect while controlling for the effects of pain severity in the model (.14, $Z = 2.99$, $p < .05$, 95% bootstrapped CI = .02 to .27). There was not a significant direct effect of pain interference on exhaustion ($c' = .24$, $p = 0.13$), and this relationship did not vary between individuals, ($V_{c'j} = .23$, $p < .23$).

Supplemental Analyses

Additionally, analyses were conducted to determine if moderators exist in the data. Specifically, the strength of the relationship between negative affect and emotional exhaustion was shown to vary between individuals. Thus, the goal of these analyses is to determine if factors at the between-individual level (i.e. supervisor and coworker support) impact this relationship. The results of the random effects model indicate that statistically significant, between-individual variation exists in the relationship between negative affect and emotional exhaustion. Additionally, theory supports the assertion that certain workplace factors may moderate this relationship (e.g. Hobfoll, 1989).

I tested two separate cross-level moderated mediation models with the path linking negative affect to emotional exhaustion (b') moderated by the level two variables (i.e. coworker and supervisor support, respectively). In accordance with Edwards and Lambert (2007), the interactions were tested by regressing the level two moderator variables onto the random vector of slopes encompassing path b'. In both cases, the path coefficient was nonsignificant (supervisor support, b = .032, p = .759, and coworker support, b = -.059, p = .497), indicating that the variation in random slopes was not predicted by either variable, and, thus, no moderation exists.

CHAPTER 5

DISCUSSION

Chronic pain is pervasive in the United States, affecting over 100 million people every day, and it is also one of the leading causes of work-related disability (Jensen & Turk, 2014; Simon, 2012; Turk & Okifuji, 2002). Despite there being an abundance of research in the field of psychology on chronic pain, relatively little is known about what happens when pain interferes with an individual's job. Laboratory studies, which were prominent in early pain interference research, tell us little about the onset and course of pain during daily life. These studies also ignore the potential negative psychological consequences of pain by strictly focusing on the relationship between pain and task performance. Additionally, although studies of the contributions of environmental stress on pain have been published for years (e.g., Feuerstein, Sult, & Houle, 1985), few have examined how momentary stress influences the health experience as people go about their daily lives. This study advances the current literature by providing evidence of an affective mechanism through which experiences of pain interference in the work environment relate to proximal psychological outcomes (i.e. exhaustion). In doing so, I put forth transactional model of stress and affect events theory as important theoretical perspectives for the study of health and work.

To establish the scope of the problem of chronic pain interference, I also sought to extend the focus to include the outcomes of pain interference. In this study, I addressed many of the limitations in the extant literature by exploring the process through which pain interference in the workplace leads to individual well-being, while taking into account the dynamic nature of the pain experience.

Results from a multi-level path analysis revealed that negative affect experience mediated

the relationship between pain interference in the workplace and daily exhaustion, as expected. This study illustrates that workers with chronic pain face daily fluctuations in the degree to which illness symptoms interfere with their ability to work effectively, and, in turn, can elicit negative emotional reactions that ultimately manifest as exhaustion. Although the correlation between daily change in pain interference and change in pain severity was high in the model (r = .35), the effects of pain interference remained. Thus, this study found that the effect of daily fluctuations in pain interference at work persists above and beyond the effects of daily pain severity. These findings highlight the importance of individual affect and chronic pain in the workplace and also indicate that the intersection between chronic pain and the work environment is a promising area of future research.

These findings are in line with similar research exploring chronic pain in the work environment. For example, in a recent study of over 70,000 working Canadians, the combination of having a chronic pain condition and overall work stress emerged as the strongest predictor of major depression (Munce, Weller, Robertson-Blackmore, Heinmaa, Katz, & Stewart, 2006). However, adding to the extant literature, the findings from this study indicate the existence of a possible moderator of the path linking negative affectivity to emotional exhaustion, although none were found in this study.

Conservation of resources theory suggests that stress appraisal arises from perceived threat to their resources (e.g. time, money, and energy; Hobfoll, 1989). Indeed, in the service industry work environment, as in this sample, negative affect can be seen as a threat to resources. According to this theory, individuals will experience strain and engage in withdrawal behaviors as a result of this threat when they do not have the personal resources to address the stressor, or invest in further resources when adequate resources are present. Thus, in the presence of

additional work-related resources, the relationship between negative affect and emotional exhaustion should be weaker. Existing literature on social support relevant to this study also supports this assertion (Cano, 2004; Viswesvaran, Sanchez, & Fisher, 1999). However, no evidence of moderator was found in this sample. This could be because the benefits of social support take effect over longer periods of time, and, thus, I did not find these effects on the daily level. It is possible that this was a function of our relatively small sample size at the group level (N = 86) and the difficulties in detecting significant interaction effects **(**McClelland & Judd, 1993), although we cannot know this with the current data.

Practical Implications

Working with chronic pain presents unique challenges for individuals. For example, managing symptoms at work, attaining accommodations, communicating about the illness, and considering health limitations are all challenges that may be stressful and lead to strain (McGonagle, Beatty, & Joffe, 2014). To enable individuals to effectively manage both their illness and their work without serious repercussions, it is important for employers to improve the well-being of workers with chronic pain by supporting and facilitating their efforts to overcome health-related limitations at work. Understanding different types of distress in those managing chronic pain is the first step for employers in helping individuals manage their illness within workplace. Given the documented effects of active coping on stressor-strain relationships (Ganster, 2008), and specifically for workers with chronic pain (Phillips et al., 2012), I advocate that decision makers develop programs that not only increase accessibility of resources and support, but also target the cognitions and emotional/physiological responses of individuals directly. From a practical standpoint, interventions that target objective working conditions are lacking if they do not effectively alter the cognitive appraisals of the participants. Thus

intervention approaches should consider both the working environment and the cognitions and emotional/physiological responses of individuals directly. Coping may be emphasized, as positive coping skills (including positive self-talk and less catastrophizing) may improve the negative effects of chronic pain and lead to higher levels of task persistence (Karoly, Ruehlman, & Okun, 2013) To this end, a study of individuals with rheumatoid arthritis conducted by Lumley and colleagues (2014) found that cognitive-behavioral coping skills training (CST) was effective in reducing pain and psychological symptoms over a 12-month period.

Although managers cannot influence when an employee's back hurts or arthritis flares up, employees experiencing pain may benefit if managers give them more control over how and when they work. Increasing employees' control over their work lives may also help them manage and reduce the negative consequences of their pain (Teasell & Bombardier, 2001).

Limitations/Future Directions.

This study has limitations that future research may address. The primary limitations concern the inclusion of negative affectivity as a mediator variable in the aforementioned model. Negative affectivity is a construct that reflects individual differences in the tendency to experience negative emotions. There is little doubt that negative affectivity (NA) plays a role in the stressor-stain processes and should be considered in job stress research. However, there is debate around whether NA is a source of bias in self-report studies of job stressors and job strains that should be statistically controlled (Watson, Pennebaker, & Folger, 1987), or a substantive variable that should be embraced to better understand the stressor-strain relationship (Spector, Zapf, Chen, & Frese, 2000; Perrewe & Zellars, 1999).

I agree with the argument that NA should *not* be statistically controlled in most situations because both theory and research point to the prominent role of affectivity in the stress process

(Perrewe & Zellars, 1999). Based on the literature presented in this study, there is clear support for the substantive role of emotion and specifically negative affect linking the experience of chronic pain to exhaustion. However, there may be methodological concern about whether negative affect is acting as a control variable or a substantive variable in this study. This concern is based on two points. First, negative affect and pain interference were measured at the same time point, thus temporal precedence cannot be established. This is indeed a limitation in the current study; however, this concern is partially mitigated by the examination of pain interference and negative affect as fluctuations from each participant's weekly average. By using deviations as opposed to absolute values in the model, the biasing effects of trait negative affect are attenuated. This approach is supported by Perrewe and Zellars (1999) who call for more work stress research on the within-person variation in emotional states, which they believe are more proximally related to individual behavior, such as coping.

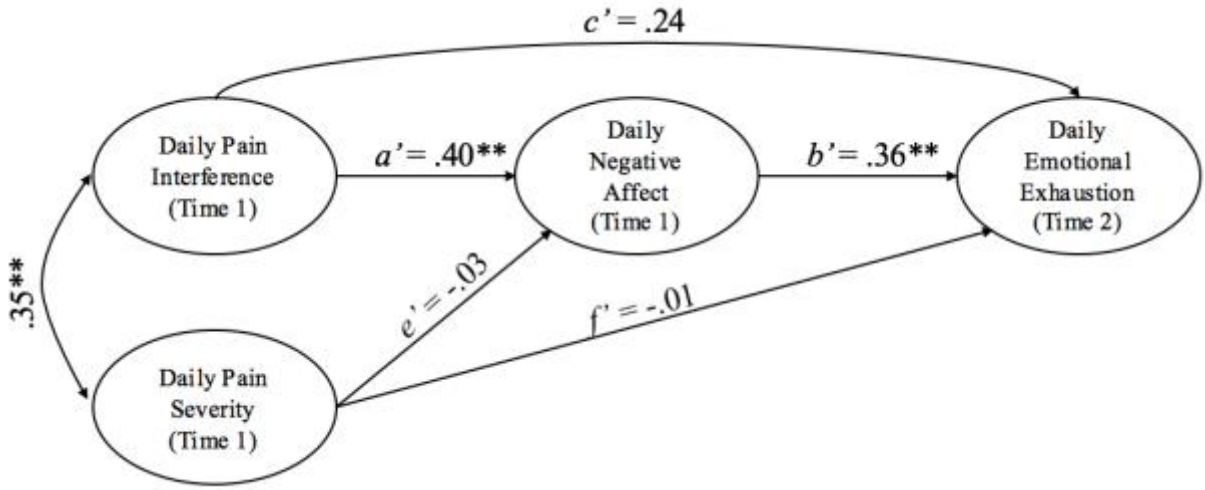
Secondly, negative affect is included as a mediator variable which brings with it methodological challenges. Under traditional approaches to mediation analysis (i.e. Baron & Kenny, 1986), it is difficult to determine if the weakening that results from the inclusion of a mediator variable is caused by a substantive mediation relationship, or by the control of variation due to response bias associated with a specific trait (i.e. negative affect). However, because a more direct test of indirect effects was used in a single model with deviations as variables, many of the concerns associated with the Baron and Kenny (1986) approach were addressed. Furthermore, if the appraisal process, including emotional response, does substantively mediate the stressor-strain relationship and NA is significantly related to emotional states as expected, then statistically controlling for NA would dramatically reduce the direct effect of stressors on strain, potentially resulting in type II error.

Future research may expand upon the approach taken in this study of examining fluctuations in one week by examining longitudinal effects (i.e., cross-lagged designs) of chronic pain in the workplace. For example, research may want to explore the effects of coping strategies on pain-related, psychological recovery over the course of a work week, and the interaction of pain-related and work-related demands.

Future research could also examine other possible moderators (buffers) of the paths in the model, including individual factors, such as coping, and organizational factors (e.g., work conditions, wellness programs, etc.) that may impact the daily experiences of chronic pain at work in order to inform workplace interventions, as I mentioned above. For example, Jensen and colleagues' (1991) review of chronic pain coping strategies found that people coped better when they believed they could control their pain, avoided catastrophizing about their situation, and believed they did not have a severe disability. Future research may also investigate how managers can successfully shield their employees from the negative effects of chronic pain through well-designed interventions.

FIGURE

Figure 1.
Model linking pain interference and pain severity in the workplace mid-day to end-of-day exhaustion through negative affect.



Note. Path coefficients represent the average random effect across participants. * $p<.05$. ** $p<.01$

TABLES

Table 1.
Distribution of Measures Used

Baseline	Time 1 (Morning)	Time 2 (Evening)
Coworker Support	Pain Interference	Exhaustion
Supervisor Support	Pain Severity	
	Negative Affect	

Note. The first survey was completed between 11:30am and 1:30pm and the second was completed between 3:30pm and 6:30pm (all times were local time in the respondents' respective time zones).

Table 2
Means, Standard Deviations, ICC1s, Correlations, and Reliabilities

	M	*SD*	*ICC1*	1	2	3	4	5	6
1. Pain Interference	1.92	.92	.66**	(.92)	.71**	.57**	.75**	-	-
2. Negative Affect	1.78	.82	.58**	.62**	(.84)	.73**	.41**	-	-
3. Exhaustion	2.46	1.21	.41**	.47**	.58**	(.89)	.35**	-	-
4. Pain Severity	4.55	2.50	.69**	.70**	.37**	.27**	(-)	-	-
5. Coworker Support	3.87	.95	-	-.13**	-.07	.00	-.11*	(.71)	-
6. Supervisor Support	3.44	.91	-	-.28**	-.13**	-.09	-.36**	.35**	(.77)

Note. Within-person correlations (n =860) are below the diagonal, and between-person correlations (N = 86) are above the diagonal. All scales were measured on a 1-5 Likert scale except Pain severity, which was measured on a 0-10 scale. Within-person internal consistency reliabilities appear in parentheses along the diagonal. Between-person correlations involving within-person variables are based on averages across measurement occasions. ICC1 = intraclass correlation. * p<.05. ** p<.01

APPENDIX A

Chronic pain

Items from Cleeland and Ryan (1994) Brief Pain Inventory.

Pain Severity.

Directions: Please rate your pain by marking the box beside the number that tells how much pain you have right now.

0 (no pain) – 10 (pain as bad as you can imagine) and N/A

Pain Interference.

Directions: So far today, how much has your pain interfered with your:

General activity

Mood

Walking ability

Normal work

Relations with other people

0 (does not interfere) – 10 (completely interferes) and N/A

APPENDIX B

Negative Affect

Items taken from Watson, Clark, and Tellegen (1988) Brief Measure of Positive and Negative Affect.

Directions: Please indicate to what degree you feel the following emotions right now.

Afraid

Upset

Determined

Guilty

Scared

Frustrated

Bored

Hostile

Jittery

Ashamed

Nervous

Sad

Distressed

1 (not at all) – 5 (very much)

APPENDIX C

Exhaustion

Items adapted from Wharton, 1993 Emotional Exhaustion Scale.

Directions: Please indicate how much the following is true for you right now.

I feel emotionally drained from my work

I feel used up

I feel burned out

I feel frustrated by my job

I feel I'm working too hard on my job.

1 (not at all) – 5 (very much)

APPENDIX D

Coworker Support

Items taken from Haynes and colleagues' (1999) measure of perceived work characteristics.

Directions: Please indicate how much you agree or disagree with each of the following statements.

My coworkers listen to me when I need to talk about work-related problems.

My coworkers help me with difficult tasks.

My coworkers help me in crisis situations at work.

1 (strongly disagree) – 5 (strongly agree)

APPENDIX E

Supervisor Support

Items taken from Eisenberger and colleagues' (2002) measure of perceived supervisor support.

Directions: Please indicate how much you agree or disagree with each of the following statements.

My supervisor is helpful to me in getting the job done.

My supervisor is willing to extend himself/herself to help me perform my job.

My supervisor takes pride in my accomplishments at work.

My supervisor tries to make my job as interesting as possible.

1 (strongly disagree) – 5 (strongly agree)

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ABSTRACT

PAIN INTERFERENCE, EXHAUSTION, AND THE MITIGATING ROLE OF NEGATIVE AFFECT: A DIARY STUDY OF WORKERS WITH CHRONIC PAIN

by

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Chronic pain is prevalent, affecting an estimated 116 million Americans (Jensen & Turk, 2014), and it is one of the leading causes of work-related disability in the U.S. (Sprigg, Stride, Wall, Holman, & Smith, 2007). Therefore, pain interference at work is an important topic for organizational researchers, yet there is currently a lack of research in this area. Drawing on theory related workplace stress and the chronic pain literature, I proposed a model in which fluctuation in pain interference with work is related to negative affective responses, above and beyond daily fluctuations in pain severity, which, in turn, manifests in end-of-day exhaustion for workers. Participants (N = 86 full-time workers with chronic pain) completed two surveys per day for five consecutive workdays, resulting in N = 860 measurement occasions measuring pain interference with work, pain severity, negative affect, and emotional exhaustion. Results from a multi-level path analysis revealed that negative emotional reactions mediated the relationship between pain interference and daily exhaustion, and that the effects of pain interference persist above and beyond those of pain severity, as expected. Additionally, I examined possible moderators (buffers) of this process (i.e. coworker and supervisor support); however, no evidence of moderation was found. Future research may explore other moderators including

individual factors, such as coping, and organizational factors (e.g., work conditions, wellness programs, etc.) in order to inform workplace interventions.

AUTOBIOGRAPHICAL STATEMENT

Zachary Lewis Fragoso was born in Dearborn, Michigan, and attended High School at Detroit Catholic Central. During high school, Zachary met his soon-to-be wife, Melanie Hengesbaugh at Ladywood High Schhol in beautiful Livonia, Michigan. Then, they both attended university, with Zachary earning a bachelor's degree in psychology from Wayne State, and Melanie earning a bachelor's of nursing from Madonna University. During Zachary's time at university, his interest in human health lead him to achieve a certification in emergency medicine and paramedic license. It is this experience that ignited his interest in occupational health research. Zachary is currently a PhD candidate in Industrial/Organizational Psychology at Wayne State University in Detroit, Michigan studying Occupational Health Psychology.

Professionally, Zachary Fragoso has consulted for a number of local organizations in the Detroit, Michigan area and has experience in the areas of assessment, selection, analytics, performance/talent management, and leadership development. This has included work with the Detroit Police Department, the Detroit Symphony Orchestra, and American Axle & Manufacturing. Most recently, Zachary has taken a research assistant position at Karmanos Cancer Institute through Wayne State University School of Oncology where he will be study return-to-work among cancer survivors.

As an employee at WSU, Zachary lives in Midtown, Detroit and enjoys spending time with his wife, Melanie, and cats (Elsa, Kirby). In the rare event that spare time emerges, he enjoys exploring neighborhoods, traveling, and doing outdoor activities—hiking, camping, running, snowboarding, and bicycling.