

University of Nevada, Reno

**The Influence of Non-Malignant Chronic Pain on Decision-Making  
Among Undergraduate Students**

A dissertation submitted in partial fulfillment of the requirements for the degree of  
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by

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## ABSTRACT

College students engage in high rates of risky behaviors. This study sought to examine the interactive effect of chronic pain (CP) and pain awareness on risky decision-making, as well as the impact of CP on academic achievement and quality of life of college students aged 18 to 24. Participants completed measures of pain, mood, attention, and decision-making, as well as either a pain awareness prime task or control task. One-hundred college students with CP who completed all measures except for the IGT, as well as 33 students with CP who completed all measures including the IGT were matched to students without pain (NP) for data analyses. Results revealed that CP and NP students did not differ in risky decision-making, but CP students reported significantly poorer academic achievement scores than NP students. Also, CP students who reported high mood disturbance reported significantly poorer quality of life. Mood explained a significant amount of the variance in quality of life scores for CP students, while sociodemographic variables explained a significant amount of the variance in academic achievement. Post-hoc analyses revealed that, while CP and NP students differ with respect to academic achievement and quality of life, they do not differ on perceived life control or activity engagement. Results of this study reveal that college students with chronic pain may benefit from screening in order to prevent and treat mood disorders, as well as skills focused on balancing resources across life domains. Future studies are needed to replicate and extend current findings.

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## **The Influence of Non-Malignant Chronic Pain on Decision-Making Among Undergraduate Students**

### **Introduction**

#### **Chronic Pain is a Prevalent Condition**

Chronic pain is a widespread problem within the United States. Over 80% of physician visits are due to pain (Debono, Hoeksema, & Hobbs, 2013; Turk & Dworkin, 2004). As pain is a major public health issue, it has been established as the fifth vital sign to be assessed in primary and emergency care (Berdine, 2002; Gatchel, 2004; Tan, Jensen, Thornby, Rintala, & Anderson, 2008). The Center for Disease Control (CDC) highlighted chronic pain as a special feature in their annual publication of “Health, United States” (2006). Data collected for the purposes of this publication indicated that 42% of individuals surveyed had experienced pain lasting for one year or longer (CDC, 2006). For adults aged 18 and older, the rates of low back pain and neck pain occurring for a 24-hour period in the three months prior to the survey were 29% and 15%, respectively (CDC, 2014).

Estimates of the prevalence of pain vary depending on the population sampled and the definition of pain. Statistics suggest that persons with chronic pain are likely to be aged 55 and older, Caucasian, female, less well-educated, working, and making \$25,000 to \$74,999 (Hardt, 2008; Johannes et al., 2010; Loeser & Melzack, 1999; Tsang et al., 2008; & Watkins et al., 2008). While statistics indicate that persons with chronic pain are likely to be Caucasian, there is evidence to suggest that findings regarding ethnicity are due to a bias in sampling. A study conducted by Portenoy et al. (2004) revealed that chronic pain was evidenced equally across populations of Caucasian,

African-American, and Hispanic individuals. Individuals with chronic pain are likely to be older as it has been estimated that the most common types of pain for the US population are those that develop with age. These include: low back pain, osteoarthritis, rheumatoid arthritis, and fibromyalgia. Given that the latter three pain types are more common for a female population, it makes sense that people with chronic pain tend to be female. Estimates for the percentage of the population impacted by low back pain is 18% to 29% (CDC 2014; Johannes, Kim Le, Zhou, Johnston, and Dworkin, 2010). Prevalence estimates for osteoarthritis and rheumatoid arthritis are 16% and 6%, respectively. Finally, estimates for the prevalence of fibromyalgia range from 2% to 5% (Johannes et al. 2010; Lawrence et al. 2008.)

Johannes et al. (2010) sought to determine the prevalence of chronic pain by conducting a population-based, internet survey of a representative US population totaling 27,035 individuals. Whereas the International Association for the Study of Pain (IASP) defines chronic pain as pain lasting for three or more months (IASP, 1986), Johannes et al. (2010) defined chronic pain as pain lasting for six or more months. Even with this more stringent criterion, a staggering one-third of the sample reported the experience of chronic pain. It is important to note that these prevalence rates were based only on individuals with physician-diagnosed pain complaints. Because these figures do not reflect persons with undiagnosed pain problems, the estimates reported by Johannes et al. are still likely to be an underestimation of the prevalence of chronic pain.

### **Chronic Pain is Associated with Significant Economic and Societal Costs**

The monetary costs associated with chronic pain are immense. Chronic low back pain accrues costs of \$96 million to \$200 billion annually (Mehra et al. 2011). Arthritis

and other rheumatic conditions accrue costs spanning from \$47 billion to \$81 billion (Yelen et al. 2007). Recent estimates of the cost of chronic pain indicate that the past, commonly cited figure of around \$70 billion dollars (Gatchel, 2004) is an underestimation. Data from the 2008 Medical Expenditures Survey indicated that the total incremental costs of health care due to pain ranged from \$261 to \$300 billion dollars. Estimations revealed that a person reporting moderate pain incurred health care expenditures \$4,516 higher than for someone without pain. For a person reporting severe pain, health care expenditures were \$7,726 higher than for someone without pain. Of the \$261 to \$300 billion dollars spent on the treatment of chronic pain, it was estimated that private insurers paid \$112 to \$129 billion. Individuals paid an additional \$44 to \$51 billion in out-of-pocket health care expenditures. Of most importance on a societal level are the costs incurred by Medicare and Medicaid. These costs were immense, with Medicare paying 25% (\$66 to \$76 billion) and Medicaid paying about 8% (\$20 to \$23 billion) of the incremental costs of treatment for pain (Gaskin & Richard, 2012).

While Gaskin and Richard (2012) calculated healthcare cost by pain severity, Stockbridge, Suzuki, and Pagan (2015) examined the cost of healthcare by pain interference. In contrast to pain severity, pain interference is a measure of how much pain prohibits daily functioning. Chronic pain interference was divided into categories of “none”, “a little bit”, “moderate”, and “severe.” Based on adjusted average per person annual total healthcare expenditures, “a little bit” of chronic pain-related interference was associated with a \$2,498 increase, “moderate” pain-related interference was associated with a \$3,707 increase, and “severe” pain-related interference was associated with a \$5,804 increase in expenditures over no pain-related interference. The authors posit that

with 16% of the US population over the age of 18 reporting “a little bit’ of pain interference, this will result in substantial annual accumulated healthcare costs.

In addition to immense healthcare costs, chronic pain also causes monetary loss in the form of lost work productivity due to days absent from employment. It has been estimated that the average annual cost of back and neck pain per employee is \$1,727, with a little over half of this cost being due to lost work productivity (Learner et al., 2015). Taking into account three components of productivity (number of days missed, number of annual hours worked, and hourly wages), it has been estimated that the value of lost productivity due to chronic pain ranges from \$299 to \$334 billion (Gaskin & Richard, 2012). While most estimates of lost productivity focus on days missed from work, it has been argued that reduced work performance due to pain, not absences from work, is the primary cause of lost productive time (Stewart, Ricci, Chee, Morganstein, & Lipton, 2003).

Stewart et al. (2003) examined the relation of pain to work productivity, including reduced performance at work. Survey data from the American Productivity Audit revealed that 53% of the workforce reported having headache, back pain, arthritis, or other musculoskeletal pain in the past two weeks. Of this, 13% of the total workforce sampled experienced a loss in production within a two-week period due to a chronic pain condition. Reduced performance at work was determined by how often a person lost concentration, repeated a job, worked more slowly than usual, felt fatigued, did nothing at work, and how long it took to start working upon arrival on days when pain was debilitating. Headache was the most common condition leading to lost productivity, followed by back pain, arthritis pain, and other musculoskeletal pain. When accounting

for all pain conditions, an average of 4.6 hours of work per week was lost. It was revealed that the majority of productive work time lost was due to reduced performance while at work (77%), not absence from work (Stewart et al., 2003).

Overall, the costs incurred by chronic pain through both healthcare utilization and lost work productivity are overwhelming. It has been estimated that the total annual costs of pain in the US, combining the costs of healthcare and work productivity, ranges from \$560 to \$635 billion dollars. This is more than the cost of heart disease (\$309 billion), cancer (\$243 billion), or diabetes (\$188 billion; Gaskin & Richard, 2012). The estimated individual out-of-pocket \$44 to \$51 billion in health care expenditures only begins to describe the cost to individuals suffering from a chronic pain condition. Adding to the monetary loss caused by chronic pain are the losses associated with pain across physical, occupational, interpersonal, and emotional domains.

### **Chronic Pain is Also Associated with Significant Costs for the Chronic Pain Sufferer**

As staggering as the financial impact of chronic pain is the cost to the individual with chronic pain with regard to impaired functioning across life domains, leading to disability. (Keefe et al., 1992; Turk & Okifuji, 2002). While prevalence statistics indicate that the typical chronic pain sufferer is older, due to the prevalence of chronic pain conditions that occur insidiously with age, injury is likely to lead to chronic pain as well. There is literature to support evidence of impaired functioning across persons experiencing chronic pain from both insidious and injurious circumstances (e.g., Duckworth, Iezzi, & Lewandowski, 2008; Reynolds et al., 1992; Turk et al., 2003; Woolf & Pfleger, 2003). The American Medical Association (AMA) defines impairment as, “An alteration of an individual’s health status; a deviation from normal in a body part or

organ system and its functioning” (Cocchiarella & Anderson, 2001, p. 2; Cocchiarella , Turk, Anderson, 2000). In some cases, impairment can lead to disability. The definition of disability can vary, due to differing requirements for disability compensation. The general AMA definition for disability is, “An alteration of an individual’s capacity to meet personal, social, or occupational demands because of an impairment” (Cocchiarella & Anderson, 2001, p. 2). The World Health Organization (WHO) defines disability more broadly as, “An activity limitation that creates difficulty in engagement of an activity within the range considered normal for a human being. Difficulty encompasses all of the ways in which the performance of the activity may be affected” (WHO, 1980). Finally, the social security administration defines disability very specifically as “The inability to engage in any substantial, gainful activity by reason of and medically determinable physical or mental impairment(s), which can be expected to result in death or which has lasted and can be expected to last for a continuous period of not less than 12 months” (Social Security Administration, 2006). Regardless of the technical definition used, the multiple definitions of disability all suggest that chronic pain has the potential to result in significant loss of functioning across physical, occupational, interpersonal, and emotional life domains (Turk & Okifuji, 1996).

**Chronic pain leads to disruptions in physical functioning.** Among a general population, 57 million people reported a physical disability in 2010 (Brault, 2012). Among a population suffering from chronic pain, it was estimated that 21 million adults are affected by arthritis, which is the most common disability in the US (CDC, 2013). In addition, eight million people reported physical disability due to back or spine problems (CDC, 2009). Physical functioning encompasses several aspects of daily life, including

the ability to engage in activities such as self-care, household chores, walking, strength, and endurance (Turk et al., 2003). Musculoskeletal pain conditions including osteoarthritis, rheumatoid arthritis, and low back pain are among the leading causes of physical disability worldwide (Woolf & Pfleger, 2003). Other chronic pain conditions including headache and fibromyalgia also significantly impair physical functioning (Monzon & Lainez, 1998). Persons suffering from fibromyalgia evidence significant difficulty moving, walking, or exercising as well as engaging in normal daily life and household activities (Mease et al., 2008).

While chronic pain may develop insidiously over time with age, research outlines poor prognosis for physical abilities in the context of chronic pain resulting from physical injury. Severe injuries are more likely to result in functional limitations, pain, and lifestyle impairment (Duckworth, Iezzi, & Lewandowski, 2008). When compared to a general population, individuals who are hospitalized for injuries experience higher disability across health domains. Associated with worse health status are those patients hospitalized for injuries to the spinal cord and fractures of the hip and other lower extremities (Meerding et al., 2004). Impairment in physical functioning may be considered the first step into a series of losses, followed by loss of employment and income, leading to financial stress, which may exacerbate losses in the interpersonal and emotional domains.

**Chronic pain leads to disruptions in occupational functioning.** Physical impairment leads to a disruption in activity engagement, which includes occupational activities. In a sample of the general population, 19% reported a physical disability and 29% of this sample continued to work with disability-related problems. Fifteen percent

had trouble remaining steadily employed and 29% were limited in the type of work they could engage in (Brault, 2010). In examining disability and occupational functioning, it was discovered that 53% of those reporting a disability and continuing to work reported headache, back pain, arthritis, or other musculoskeletal pain. A loss in production was experienced by 13% of the sample, with 77% of productivity time lost being due to reduced performance at work (Stewart et al., 2003). Physical impairment that disrupts ability to engage in occupational activities may limit an individual's ability to earn an income.

Low household income and unemployment are significant socioeconomic correlates of chronic pain (Elliott, Smith, Penny, Cairns-Smith, & Alastair-Chambers, 1999; Johannes et al., 2010; Smith et al., 2001). Research indicates that persons suffering chronic pain conditions from both insidious and injurious onset are at increased risk for occupational disability (Buse, Manack, Serrano, Turkel, & Lipton, 2010; Duckworth et al., 2008; Hebert & Burnham, 2000; Meerding et al., 2004; Schaefer et al., 2011). Overall, 50% of subjects with fibromyalgia reported some disruption in their employment due to chronic pain. Persons with fibromyalgia who were employed reported missing an average of 1.8 work days per month (Schaefer et al., 2011).

Occupational functioning has also been found to be influenced by the extent of physical impairment experienced by persons with chronic pain resulting from injury (Duckworth et al., 2008). Persons with more severe injuries evidence more disability and less return to work (Hebert & Burnham, 2000). In the context of injury, number of work days lost was significantly greater for persons who had been hospitalized (Meerding et al., 2004). Taken together, pain-related disruptions in physical ability and in

occupational functioning may be considered the start of a series of lifestyle disruptions that lead to increased interpersonal and emotional distress (Duckworth et al., 2008; Iezzi, 2008).

**Chronic pain leads to disruptions in interpersonal functioning.** Chronic pain is a significant cause of loss of physical functioning and loss of occupational productivity. Given that pain is associated with losses in physical and occupational functioning, it follows that losses would occur in the domain of interpersonal functioning as well. Unfortunately, there is a lack of research addressing interpersonal functioning in a population-based, quantitative manner. However, there is research establishing the significant impact of chronic pain on social relationships (Burman & Margolin, 1992; Flor, Turk, & Scholz, 1987; Maruta, Osborne, Swanson, & Halling, 1981; Kiecolt-Glaser & Newton, 2001; Leonard, Cano, & Johansen, 2006). There is literature suggesting that marital and sexual satisfaction declines after the onset of chronic pain symptoms (Flor et al., 1987; Maruta, Osborne, Swanson, & Halling, 1981). Additionally, there is literature to suggest that marital functioning affects and is affected by pain intensity, physical disability, pain behaviors, and psychological distress (for a review, see Leonard, Cano, & Johansen, 2006).

In the context of injury leading to pain, further stressors involved in the pain experience may include hospital admissions and litigation proceedings (Duckworth et al., 2008). These stressors can increase financial burden, further increasing strain on social relationships affected by chronic pain. Research on social functioning among persons with chronic pain resulting from injury have established a loss of satisfaction with social functioning. DePalma, Fedorka, and Simko (2003) found severe disruption in social

interactions for a population of injured trauma survivors. Mayou and Bryant (2003) investigated the functioning of drivers, passengers, motorcyclists, cyclists, and pedestrians who had been physically injured in an accident. The authors found that one-third of all groups reported chronic adverse legal, social, and psychological consequences. Although there is a lack of research addressing interpersonal functioning in the context of chronic pain in a population-based, quantitative manner, the existing literature indicates that interpersonal functioning is negatively impacted in the context of chronic pain.

**Chronic pain leads to disruption in emotional functioning.** Given the disruptions in physical, occupational, and interpersonal functioning that are a result of chronic pain, it is not surprising that persons with chronic pain experience significant emotional distress. Persons experiencing chronic pain have noted that they can cope with the pain experience, but cannot cope with being unable to engage in activities of daily living, work, and social relationships (Duckworth, 2008). Kroenke and Price (1993) found that among persons seeking care for joint pain, back pain, and headaches, pain was associated with an increased lifetime risk of psychopathology.

The impact of chronic pain on emotional functioning is highlighted when comparing rates of psychopathology between a general population and a chronic pain population. For a general population, it is estimated that 10%-21% suffer from depression, 18% to 29% suffer from anxiety, 10% to 15% engage in substance abuse, and 4% suffer from Post-Traumatic Stress Disorder (PTSD; Kessler, Chiu, Demler, Merikangas, & Walters, 2005). These estimations almost double for a population with chronic pain. It is estimated that 26%-54% suffer from depression, 17% to 35% suffer

from anxiety, 10% to 28% engage in substance abuse, and 10% to 11% suffer from PTSD (Dersh, Polatin, & Gatchel, 2002).

The context leading to chronic pain can influence likelihood of type of psychopathology that may develop. In the context of chronic pain resulting from conditions associated with insidious onset, comorbidity with depression and anxiety is common (Banks & Kerns, 1996; Dersh, Polatin, & Gatchel, 2002). In the context of injury leading to chronic pain, significant psychological distress may be expected when injuries are severe and when chronic pain results in poorer quality of life (Blanchard et al., 1996; DePalma et al., 2003; Duckworth, 2008; Maes et al., 2000; Mayou & Bryant, 2003; Sluys, Haggmark, & Iselius, 2005). Major depression and PTSD are the psychological disorders experienced most frequently by persons who have sustained traumatic injury (Duckworth et al., 2008). Jenewein et al. (2009) examined chronic pain and psychological factors among persons having experienced severe accidental injuries and found that individuals with chronic pain showed significantly more symptoms of depression, anxiety, and PTSD. The literature indicates that, regardless of type of onset of chronic pain, mental health diagnoses are likely to co-occur.

**Chronic pain negatively affects quality of life.** The intercorrelations of losses across physical, occupational, interpersonal, and emotional life domains in the context of chronic pain ultimately lead to a poorer quality of life. Chandarana, Jackson, Kohr, and Iezzi (1997) found that extended occupational disability was associated with lower income levels and longer duration of psychiatric illness. An investigation of life domains across employed and non-employed individuals, both with and without chronic pain, indicated that participants experiencing both chronic pain and unemployment reported

poorer adjustment and more financial strain than the other groups. Participants experiencing chronic pain and unemployment also reported decreased social support (Jackson, Iezzi, & Lafreniere, 1996). Finally, psychosocial measures including perceived financial security, skill use, and social support were found to be significant predictors of emotional distress among persons with chronic pain (Jackson, Iezzi, & Lafreniere, 1997). Taken together, the overall impact of losses across life domains to the individual suffering from chronic pain is a significant overarching loss of quality of life.

There is much literature examining the negative impact of pain on quality of life post-surgery, but less literature examining the impact of chronic pain conditions on quality of life. There is preliminary research to suggest that chronic pain negatively impacts quality of life through interfering with relationships, loss of sleep, fatigue, absence from and inability to work, mental health, physical functioning, cognitive functioning, and financial difficulties (Fredheim, Kaasa, Fayers, Saltnes, Jordhøy, & Borchgrevink, 2008; Gold, Mahrer, Yee, & Palermo, 2009; Kalia & OConnor, 2005; Keeley, Creed, Tomenson, Todd, Borglin, & Dickens, 2008; Vo, Marx & Penles, 2008). While there is preliminary research on the negative impact of chronic pain on quality of life for a clinical population with chronic pain, the relation of chronic pain to quality of life is unclear for a non-clinical population of persons with chronic pain who are not significantly impaired or disabled.

**Chronic pain in the absence of significant disability.** The link between chronic pain and quality of life is clear when significant levels of distress and disability are present. The impact of chronic pain on quality of life in the absence of significant levels of distress and disability (in other words, a non-clinical population) is less clear. The

impact of chronic pain on quality of life in a non-clinical population becomes important when considering interventions to prevent significant impairment and disability. One variable that may be important in the transition from non-clinical to clinical chronic pain may be decision-making. Research on decision-making suggests that quality of life is positively impacted through effective decision-making. There is much research examining what differentially affects decision-making (Finucane, Alhakami, Slovic, & Johnson, 2000; Kahneman, 2011; Peters, Västfjäll, Gärling, & Slovic, 2006; Siegrist, Keller, & Cousin, 2006). However, there is only one study that examines the impact of chronic pain on decision-making (Apkarian et al., 2007). In order to develop a model of risk for significant impairment and disability, research is needed that examines the relation of chronic pain to decision-making in the absence of clinically significant impairment.

### **Decision-Making Positively Affects Life Outcomes Through Effective Risk Management**

Decision-making typically refers to choosing between more than one option or alternative. Despite the simple definition, decision-making is a broad construct that has been applied and studied across fields ranging from business, cognitive psychology, ethics, legal, medicine, and public policy (Gong, Zhang, Yang, Huang, Feng, & Zhang, 2013; Hamill, 2011; Heilbrun, 1997; Ho, Xu, & Dey, 2010; Kahnemann, 2011; Kahneman, Slovic, & Tversky, 1982; Krieger, 2012; O'Fallon & Butterfield, 2005; Peters, Finucane, MacGregor, & Slovic, 2000; Renn, 1999; Slovic, 1987). Across the varying fields of study, decision-making has been examined in relation to risk assessment and risk-management. Unsurprisingly, decision-making has been found to play an

important role in risk assessment and management, regardless of the area of application (Burns, Slovic, Kasperson, Kasperson, Renn, & Emani, 1993; Slovic, 2000; Slovic, Peters, Finucane, 2005; Zhou, Vasconcelos, & Nunes, 2008). As risk assessment and management are important for prevention of further injury and impairment in the context of chronic pain, decision-making may significantly impact quality of life.

**Theories of decision-making.** The potential impact of decision-making on quality of life through exposure to risk makes decision-making an important component of human behavior, and therefore a behavior that researchers have sought to quantify and understand. There are several theories of decision-making, but all can be organized and described by three major categories: classical decision-making theory, naturalistic decision-making theory, and the dual-process theory of decision-making. Classical decision-making theory outlines that people work like computers when making decisions. That is, they take in information, perform computations, generate options, and choose the best option. Given this computer model, researchers worked to develop the mathematical computations that were assumed to be behind human decision-making (Baron, 1994; Bernoulli, 1954; Friedman, 1953; Herrnstein & Prelec, 1991; Lipshitz et al., 2001; Simon, 1956). However, by 1989, it became clear that human beings did not function the same as computers, making rational choices computed from complex equations. The field of decision-making began to move towards developing more naturalistic models.

Naturalistic decision-making sought to explain how decision-making occurs for people who make decisions in less than optimal conditions. For example, firefighters, medical personnel, and military personnel who achieve good outcomes, despite having minimal time to react to a situation. Naturalistic decision-making posits that humans rely

on a number of simple rules, or heuristics, that are developed over time and with experience (Gigerenzer & Gaissmaier, 2011; Gigerenzer & Goldstein, 1996; Klein, 2008; Orasanu & Connolly, 1993). Both classical and natural decision-making theories help to explain the process of decision-making, but both from polar extremes of how people engage in the behavior of decision-making, and therefore neither providing an adequate description of how decision-making occurs.

In order to reconcile the two extremes of decision-making theory, the dual-process theory of decision-making was developed. The dual-process model encompasses both ends of the decision-making spectrum, positing that humans may use either slower, computer-like responses or quicker, reaction responses in decision-making situations (Epstein & Pacini, 1999; Evans, 1984; Kahneman, 2011; Kahneman & Tversky, 1982; Slovic, 1996; Stanovich & West, 2000). There are several labels for the dual-process model of decision-making, including “intuitive vs. analytical”, “implicit vs. explicit”, “automatic vs. controlled”, and “System 1 vs. System 2” (for a review, see Stanovich & West, 2000). Regardless of the label used, the characteristics defining these systems are that one decision-making system is fast and automatic, while the other decision-making system is slow and deliberate. While individuals may engage in either fast or slow decision-making, research has indicated that regardless of IQ, only half of individuals sampled are likely to employ slow and deliberate decision-making (Frederick, 2005; Kahneman, 2011). The dual-process theory of decision-making is conceptually most amenable for examining decision-making in the context of chronic pain and engagement in risky health behaviors.

**Decision-making in evaluation of risk.** Research has shown that people consistently evaluate risk inaccurately (for a full review, see Aven, 2009 and Kahneman, 2011). Risk and benefit have been shown to be inversely related depending upon affect, with individuals rating risky environmental hazards as less risky when presented in the context of favorable arguments (Finucane et al., 2000; Peters et al., 2006; Siegrist, Keller, & Cousin, 2006). Risk perception has been found to predict health-protective behavior, with breast cancer screening being predicted more by worry about breast cancer rather than genetic predisposition, and worry predicting flossing and academic behaviors (Bowen, Helmes, Powers, Andersen, Burke, McTiernan, & Durfy, 2003; Schmiede, Bryan, & Klein, 2009). Additionally, disease worries have been found to be strongly related to the perception of likelihood of contracting a disease and feelings of risk more associated with worry than with severity perception (Shiloh, Wade, Roberts, Alford, & Biesecker, 2013). Taken together, the literature examining evaluation of risk shows that people are less likely to attend to calculated levels of risk, and more likely to make decisions based on feelings and perceptions of risk.

The ability to engage in effective decision-making is important to maintaining quality of life, as actual and realistic estimation of risk is necessary to avoid deleterious health outcomes (Thornton & Dumke, 2005). Research has shown that people assess risk inaccurately the more they rely on quick and fast thinking, focusing on their affect. Mood and attention appear to be factors that make it more or less likely that a person will engage in thoughtful consideration of risk. As mood and attention are both negatively impacted by the experience of chronic pain, it is likely that decision-making is a behavior of importance for preventing further impairment for individuals with chronic pain. While

there is little research examining decision-making in the context of chronic pain, there are variables that are negatively affected by pain that have been found to influence decision-making.

### **Chronic Pain Negatively Affects Variables that Influence Decision-Making**

Mood and attention have been found to impact deliberate thinking (Finucane et al., 2000; Kahneman, 2011; Peters et al., 2006; Siegrist, Keller, & Cousin, 2006; Ruder & Bless 2003), while pain has been found to negatively impact mood and attention (Banks & Kerns, 1996; Dersh, Polatin, & Gatchel, 2002; Eccleston, 1994; Kessler et al 2005). This indicates that in examining the impact of chronic pain on decision-making, mood and attention must be taken into consideration. Outlining these relations is the first step towards consideration of a risk-management model for preventing impairment and disability in the context of chronic pain.

**Mood is negatively affected by chronic pain and differentially influences decision-making.** Research has shown that, for a general population, individuals primed to be in a “sad” mood as well as individuals who reported more depressive symptoms made decisions based on the number of reasons they generated for making a decision. However, individuals reporting a positive mood or less depressive symptoms made decisions based on how easily they could think of reasons for their decision (Finucane et al., 2000; Greifeneder & Bless, 2008; Ruder & Bless, 2003). This line of research supports that negative mood is associated with more deliberate decision-making. However, the role of mood in decision-making in the context of chronic pain is unknown.

What is known, is that in the context of chronic pain, research has shown that the presence of negative mood is more likely. Banks and Kerns (1996) searched the

literature for studies diagnosing depression using DSM-IV criteria and determined that anywhere from 30%-54% of persons with chronic pain also evidence depression. Dersh et al. (2002) reviewed the literature on chronic pain and psychological distress and determined that 17% - 29% of individuals with chronic pain evidence an anxiety disorder, including PTSD. McWilliams, Cox, and Enns (2003) noted that much of the chronic pain comorbidity data are biased as estimates are taken from only clinical samples. In order to provide estimates of arthritis pain and psychological distress for a general population, McWilliams et al. examined data obtained from the initial administration of the National Comorbidity Survey (NCS; data gathered from a sample representative of a general US population). Analyses indicated comorbidity rates for psychological distress and arthritis to be 26% for depression and 35% for anxiety.

The initial administration of the National Comorbidity Survey occurred from 1990-1992. A second administration of the survey (NCS-R) was conducted in 2000-2001. Results from this administration were evaluated in conjunction with results from other general population surveys across 17 countries by Scott et al. (2007) in order to estimate the relation between physical conditions and depression, anxiety, and comorbid depression and anxiety. Among the pain conditions examined were back and neck problems, chronic headache, and multiple pains. All three of these conditions were significantly associated with non-comorbid depressive disorder, non-comorbid anxiety disorder, and comorbid depression/anxiety disorders.

Taken together, the previously reviewed literature indicates the serious risk of developing psychological distress in the context of chronic pain across both a clinically impaired population and a non-clinically impaired population. The frequent co-

occurrence of mood disorders with chronic pain is important when considering the relation of chronic pain to decision-making, as persons with chronic pain are more likely to experience negative mood. While the impact of positive and negative mood has been found to influence decision-making in a general population, the role of mood in the context of decision-making in a chronic pain population is unknown. Given this, mood should be considered in analyses examining the relation of pain to decision-making.

**Attention is negatively affected by chronic pain and differentially influences decision-making.** Another variable that must be accounted for when examining the relation of chronic pain to decision-making is attention. Research on decision-making has revealed that when there are multiple tasks competing for attention, a general population is less likely to engage in deliberate thinking (for a review, see Kahneman, 2011). Research on the impact of pain on attention has shown that chronic pain demands attentional resources (Asmundson et al., 1997; Dick et al., 2002; Duckworth et al., 1997; Eccleston, 1994; Grisart & Plaghki, 1999).

Dick and Rashiq (2007) administered the Test of Everyday Attention (TEA) to 24 persons with chronic pain on a pain day, and then re-administered the TEA on a day where pain was relieved by an invasive analgesic procedure. Other measures included number of medications, pain intensity, pain catastrophizing, anxiety, depression, and sleep. Results revealed that participants did not differ across these measures. Univariate analyses revealed that, although participants reported a significant decrease in pain on the pain relief day, their task performance did not significantly improve. The authors claimed that there are cognitive processes that are permanently changed for individuals with

chronic pain, but it was unclear if the invasive analgesic procedure itself may have influenced attentional processes.

The results of the previous study by Dick and Rashiq (2007) were complicated by the fact that a control group was not examined. Dick, Eccleston, and Crombez (2002) administered the TEA to both individuals with chronic pain ( $n = 60$ ) and individuals without chronic pain ( $n = 20$ ). Depression, anxiety, somatic awareness, and catastrophizing were included as covariates in analyses. Results revealed that individuals without chronic pain performed significantly better overall on attention tasks than persons with chronic pain. Unlike Dick et al. (2002), Asmundson, Kuperos, and Norton (1997) failed to find a difference in attention due to chronic pain alone. The authors explored the impact of chronic pain on attention by administering a dot-probe paradigm task to 19 persons with chronic musculoskeletal pain and 22 persons without pain. The task consisted of pairings of pain/injury and control words appearing on a computer screen. Across trials, the dot probe followed either the target word or the neutral word. Participants were instructed to press a space bar when they perceived the dot. The dependent variable was the latency to respond to the dot probe. Even when controlling for depression, no significant differences in response latency were found between groups. To investigate if fear of pain influenced response latency, the chronic pain group was split into high and low fear of pain using a measure related to fear of pain, the Anxiety Sensitivity Index (ASI). Results indicated that those individuals with a higher fear of pain exhibited significantly longer latencies to responding to dot probes following pain/injury words than those participants with low fear of pain. This study suggests

different factors related to pain (such as affect) may impact the relation of chronic pain to attention.

In another study examining selective attention to pain among individuals with chronic pain, Duckworth, Iezzi, Adams, and Hale (1997) looked at somatic complaints across persons with chronic pain reporting high somatic focus (12 or more physical symptoms;  $n = 10$ ), a group of persons with chronic pain reporting low somatic focus (less than 12 physical symptoms;  $n = 9$ ), and a group of healthy controls ( $n = 10$ ). The authors administered a modified Stroop task that included neutral words as well as words pertaining to pain and depression. Across all word types, persons reporting 12 or more physical symptoms evidenced a consistent pattern of response delay. This delay pattern was better attributed to somatic focus, not level of psychological distress as measured by the MMPI. The results of this study suggest that the combination of chronic pain with many somatic complaints results in an interference in attention.

In continuing to consider the impact of mood on attention in the context of chronic pain, Grisart and Plaghki (1999) measured pain intensity, depression, and anxiety across 33 persons with chronic pain and 20 without. A four-part Stroop task was utilized to examine the relation between chronic pain and attentional deficits. Results revealed that only persons who reported high pain intensity exhibited a significant increase in response time on attention tasks when compared to participants without pain. This study suggests that it is not pain, but the intensity of the experience of pain that negatively affects attention.

The previously reviewed studies examine objective evidence for attentional issues. However, what causes distress and leads people to seek help are subjective

complaints. McCracken and Iverson (2001) examined predictors of cognitive complaints in 275 pain patients who were referred to a chronic pain center. Cognitive complaint categories included: forgetting a lot, minor accidents, not finishing things, wandering attention, making mistakes, difficulty reasoning or problem solving, confusion, reacting slowly, and behaving in a confused or disoriented manner. Fifty-four percent of the sample evidenced at least one cognitive complaint. Pain severity, pain related anxiety, depression, and use of antidepressants were found to be significantly correlated with cognitive complaints. Multiple regression analyses revealed that antidepressant use, depression, and pain related anxiety accounted for 36% of the variance in cognitive complaints. Interestingly, pain severity was not a significant predictor of cognitive complaints. The authors noted that when examining perceived functioning, individuals with chronic pain may attend more strongly to the emotional responses evoked by pain, rather than the pain itself. While previous studies highlight the impact of pain on attentional tasks in a lab setting (Asmundson et al., 1997; Dick et al., 2002; Duckworth et al., 1997; Grisart & Plaghki, 1999), the study by McCracken and Iverson (2001) showed how chronic pain may result in attention given to the emotional experience that may accompany this condition, rather than pain alone. Taken together, these studies provide evidence that chronic pain negatively impacts attention. Furthermore, the extent to which pain negatively impacts attention may be through how much a person is attending to their pain (pain awareness).

Taken together, the literature reviewed thus far examining mood, attention, and chronic pain elucidates important relations and considerations in pursuing an examination of chronic pain to decision-making. Research shows that chronic pain negatively impacts

mood and attention (Asmundson et al., 1997; Banks & Kerns, 1996; Dersh et al. 2002; Dick et al., 2002; Duckworth et al., 1997; Eccleston, 1994; Gatchel, 2004; Grisart & Plaghki, 1999; Kessler et al., 2005; McWilliams et al., 2003; O'Donnell et al., 2004; Scott et al., 2007; Turk & Okifuji, 2002; Eccleston, 1994). Within a general population without pain, negative mood has been found to lead to more deliberate decision-making (i.e., negative mood leads to reliance on number of reasons generated in favor of making a decision, whereas positive mood leads to reliance on the ease with which reasons come to mind in favor of making a decision; Finucane et al., 2000; Greifeneder & Bless, 2008; Kahneman, 2011; Ruder & Bless 2003). Finally, there is also research to support that greater demands on attentional resources can result in greater distraction (Brand-D'Abrescia & Lavie, 2008; Lavie, 2010; Wallace & Vodanovich, 2003). While these studies highlight the importance in attending to mood and attention as indicators of risk for further injury and disability in a non-clinical population of persons with chronic pain, there is little research examining the direct relation of chronic pain to decision-making.

There is one study that examines the impact of chronic pain on decision-making in the context of risk. Apkarian et al. (2007) examined performance on the Iowa Gambling Task (IGT), which is a card game that was developed to study decision-making. Participants were instructed to make choices between two decks of cards. One deck of cards produced high immediate gain, but larger future loss, while the other deck of cards produced lower immediate gain but smaller future loss. Three groups completed the IGT: persons with chronic back pain (CBP:  $n = 26$ ), persons with chronic complex regional pain syndrome (CRPS:  $n = 12$ ), and persons without chronic pain (control group:  $n = 26$ ). Univariate analysis of variance revealed that individuals with a chronic pain

condition chose most frequently from the deck producing greater short-term gains than individuals without chronic pain. A subgroup of 12 persons with CRPS and 10 persons without chronic pain were tested twice in order to compare performance on the task when accounting for pain intensity. Seven of the CRPS participants were tested before and after a sympathetic nerve block, and five were tested without the block. Participants failed to show improvement in testing when pain intensity was reported as significantly lowered. Regression analyses conducted with data from the CBP group revealed a strong negative correlation between pain intensity and performance on the IGT. This study provides preliminary evidence for the negative impact of chronic pain on risky decision-making. As with the previously reviewed literature examining the impact of chronic pain on attention, this study suggests that pain intensity may have a negative effect on decision-making in the context of chronic pain. As the authors only examined a clinical population of persons with significant impairment resulting from chronic pain, it is unknown if the results would be similar for a non-clinical sample of persons with chronic pain who are not yet significantly impaired.

### **Chronic Pain, Pain Awareness, and Impact on Decision-Making**

Chronic pain resulting in impairment leading to significant disability is accompanied by negative outcomes across physical, occupational, financial, interpersonal, and emotional life domains. The accumulation of these negative outcomes leads to poorer quality of life. Effective decision-making is a behavior that is associated with better quality of life, as effective decision-making may prevent injury. While there is one study showing the negative impact of clinically significant chronic pain on risky decision-making (Apkarian et al. 2007), it is unknown if chronic pain among a non-

clinical population of persons who are not yet significantly disabled impacts risky decision-making. Investigating the relation of chronic pain to risky decision-making among a non-clinical population may reveal variables of importance to the prevention of significant disability, therefore promoting a better quality of life.

In addition to showing a negative effect of clinical chronic pain on decision-making, Apkarian et al. (2007) also revealed that participants with chronic pain reporting greater pain intensity performed poorer on a decision-making task. The literature elucidating the negative impact of clinical chronic pain on attention suggests that current pain awareness may explain the negative impact of chronic pain on attention. In considering an examination of decision-making within a non-clinical chronic pain population, pain awareness may interact with chronic pain to result in worse decision-making.

The impact of pain awareness on decision-making for a non-clinical population with chronic pain is unknown, but it is known that a general population is subject to priming that impacts their behavior. There is research to show that mood can be successfully primed, and without participant knowledge of the priming process (Buchanan, 2015; Goldenberg & Forgas, 2012; Henderson et al., 2007; Hogarth et al., 2015, Mussweiler, 2006; Schmid & Mast, 2010; Schwarz & Clore, 1983). Further, there is research to show that negative mood has a negative impact on information processing. Storbeck and Clore (2008) primed mood with music and found that a negative mood inhibited making connections among tasks while a positive mood led to creation of more connections. Vissers et al. (2010) also found that a negative mood negatively affects processes of language comprehension. Krahe and Bieneck (2012) primed positive and

negative moods and found that persons reporting a positive mood were less likely to attend to aggressive words and less likely to respond to provocation. Within the area of pain, deWied and Verbaten (2001) examined the impact of viewing pain related images to pain tolerance during a cold pressor task. They found that participants who viewed pictures related to pain were less tolerant of the task than participants who viewed “pleasant” pictures.

The literature on priming suggests that pain related stimuli may prime for pain awareness among a non-clinical population of persons with chronic pain. Additionally, the literature examining the negative effect of clinical pain and pain awareness on attention and decision-making suggests that an increase in pain awareness may have a negative effect on decision-making. Given the ease with which people without pain are primed for mood, and the implication priming has on behaviors, the effect of pain awareness on decision-making may be an important variable to the transition from non-clinical chronic pain to clinical chronic pain. Unfortunately, there is a lack of research examining the impact of chronic pain and pain awareness among a population of persons with non-clinical chronic pain.

### **Chronic Pain, College Students, and Decision-Making**

College students with chronic pain are an example of a population of persons who experience chronic pain but are not yet significantly disabled by that experience. This population continues to engage in educational activities in the context of pain. In a survey of chronic pain prevalence among a non-clinical population, Johannes et al. (2010) found that 12% of those aged 18 to 24 reported the experience of chronic pain. Additionally, occurrence of low back and neck pain in this population are estimated at

18% and 7%, respectively (CDC, 2014). This indicates that chronic pain is a prevalent problem for college-aged individuals. However, there is a lack of chronic pain research focusing on persons aged 18 to 24, as this age group is included in studies examining an adult population (ages 18 to 64), where the mean age is typically 40 to 50 years.

The prevalence of chronic pain among those aged 18 to 24 is not the only reason to examine the impact of pain in this population. More important than pain prevalence is the fact that young adulthood is a time of transition, and many behaviors with deleterious effects on health peak during this time. College students in particular may be at most risk of becoming impaired and significantly disabled by chronic pain as risky decision-making determines engagement in behaviors that result in deleterious health effects. These behaviors include substance use and drinking and driving (Mulye, Park, Nelson, Adams, Irwin, & Brindis, 2009; Satterwhite et al. 2008). The decision to engage in these activities may lead to accidental injury, having the potential to disrupt functioning for a lifetime.

Research has shown that binge-drinking is particularly prevalent on college campuses, as the environment tends to encourage this behavior (Johnston, Bachman, O'Malley, & Schulenberg, 2006; LaBrie, Pedersen, Lamb, & Bove, 2006). College students are more likely than their peers who are not in college to report binge drinking and between 40%-45% of young adults aged 18 to 24 engaged in driving while under the influence of alcohol in 2005 (Hingson, Zha, & Weitzman, 2009). The CDC found that young adults aged 15-24 accounted for 22% Motor Vehicle Collision (MVC) fatalities in 2009 (CDC, 2012). This suggests that college students are more likely to drink and drive, exposing both themselves and others to risk of severe injury. Risk of injury is especially

important as injury is a precursor to chronic pain. Further injury in the context of existing chronic pain may begin the decline into impairment leading to significant disability.

Another consideration for college students with chronic pain is the impact of pain on academic achievement, specifically, grade point average (GPA). Research on chronic pain in children and adolescents indicates qualitatively that chronic pain impacts educational functioning. When examining the impact of chronic pain on academic functioning, literature focuses on missed school days. Studies have established that children with chronic pain miss more school days than their non-pain affected peers (for a review, see Palermo, 2000). There is evidence to suggest that the experience of pain impacts quality of life in that sleep is lost, activities are restricted, and social engagement is abbreviated (Kashikar-Zuck, Parkins, Ting, Verkamp, Lynch-Jordan, Passo, & Graham, 2010; Haraldstad, Sørnum, Eide, Natvig, & Helseth, 2011). Adolescents with chronic pain report that pain impedes their ability to succeed in school (Logan, Simons, Stein, & Chastain, 2008; Logan, Simons, & Kaczynski, 2009; Roth-Isigkeit, Thyen, Stöven, Schwarzenberger, & Schmucker, 2005). While educational functioning is important, a review by Eccleston, Jordan, and Crombez (2006) found no objective measurement of this life domain in the adolescent chronic pain literature. While education can contribute to quality of life, there is a lack of research examining this among college students with chronic pain.

### **Conclusions and Rationale for the Proposed Study**

To the author's knowledge, there are no published studies examining the impact of chronic pain and pain awareness on decision-making among a non-clinical population

of persons with chronic pain. Although the impact of chronic pain on decision-making has not been well examined, attention and mood have been found to differentially impact decision-making (Finucane et al., 2000; Kahneman, 2011; Ruder & Bless 2003), while pain has been found to negatively impact attention and mood (Asmundson et al., 1997; Banks & Kerns, 1996; Dersh et al. 2002; Dick et al., 2002; Duckworth et al., 1997; Eccleston, 1994; Gatchel, 2004; Grisart & Plaghki, 1999; Kessler et al., 2005; McWilliams et al., 2003; O'Donnell et al., 2004; Scott et al., 2007; Turk & Okifuji, 2002; Eccleston, 1994). The literature examining the negative effect of clinical pain and pain awareness on attention and decision-making suggests that, while clinical chronic pain may negatively impact decision-making, an increase in pain awareness may have an even further negative effect on decision-making (Apkarian et al., 2007; Asmundson et al., 1997; deWied & Verbaten, 2001; Duckworth et al., 1997; Grisart & Plaghki, 1999; McCracken & Iverson, 2001).

Effective decision-making results in better quality of life through decisions made regarding health, finance, interpersonal relationships, and academics. Better decisions made in the area of health in the context of chronic pain may result in less impairment and prevention of decline into significant disability. Better decisions made in the area of academics may result in the completion of a college education. Enabling individuals with chronic pain to make better decisions, especially starting at a younger age, may help to decrease the transition from non-clinical to clinical chronic pain, ultimately reducing the financial burden of healthcare for this population on society.

The prevalence of pain among the population of those aged 18 to 24, in combination with the increased behaviors of college students that increase risk of injury

during this period of life indicates the need for the clarification of the impact of pain on risky decision-making. The fact that the college environment propagates risky health behaviors that stabilize or decline in early adulthood (Kwan, Cairney, Faulkner, & Pullenayegum, 2012) makes college students with chronic pain an ideal population for examining the relation of pain to risky decision-making. The current study is necessary for clarifying the influence of pain and pain awareness to risky decision-making. This information is needed to build an impairment or disability risk assessment model for a non-clinical chronic pain population. This model would help identify persons at risk of significant impairment and disability, as well as inform interventions to help prevent further impairment and disability for these individuals.

### **Study Objectives**

The purpose of the present study was to 1) determine the main and interactive effects of chronic pain and pain awareness on decision-making among college students; 2) determine the effect of pain status on academic success and quality of life experienced by college students; and 3) determine the influence of chronic pain, mood, and decision-making on college students' academic success and quality of life.

The primary hypotheses for the current study were:

- 1) A significant interactive effect of pain status (CP, NP) and pain awareness (pain aware, control) on both *subjectively* and *objectively* measured risky decision-making would be observed, such that the presence of pain awareness for NP participants would result in little to no difference in risky *subjectively* and *objectively* measured decision-making, while the presence of pain

awareness for CP participants would result in greater risky *subjectively* and *objectively* measured decision-making.

- 2) A significant effect of pain status (CP, NP) on academic achievement would be observed, such that CP participants would evidence significantly lower academic achievement scores than NP participants.
- 3) A significant effect of pain status (CP, NP) on quality of life would be observed, such that CP participants would evidence significantly lower quality of life than NP participants.
- 4) Pain, mood, and *subjectively* measured risky decision-making would predict a significant amount of the variance in academic achievement scores and quality of life for CP participants.
- 5) Pain, mood, and *objectively* measured risky decision-making would predict a significant amount of the variance in academic achievement scores and quality of life for CP participants.

## **Method**

### **Participants**

Participants were English-speaking college students between the ages of 18 and 24, who were recruited through on-campus flyers, classroom announcements, and the online psychology subject pool website (SONA). Two groups of students were recruited: students who reported non-malignant chronic pain (CP; pain lasting three months or longer that is not episodic) and students without pain (NP; no current acute pain, history of chronic pain, or episodic pain). All participants were enrolled in classes through the University of Nevada-Reno (UNR) or Truckee Meadows Community College (TMCC).

Students were not eligible for participation if they reported a history of neurological disease, head trauma, psychiatric disorder or developmental disorder. The option to be entered into a lottery for a \$100 Amazon gift card was offered as an incentive for participation. Additionally, students enrolled in classes offering extra credit for study participation were eligible for one SONA credit per hour of study participation.

Of the students considered eligible to participate in the study, 100 CP students completed all measures except for the IGT task (CP-IGT), 33 CP students completed all measures including the IGT task (CP+IGT), and 260 NP students completed all measures. For all participant groups (CP-IGT, CP+IGT, and NP), participants ranged in age from 18 to 24 years ( $M = 20.1$ ,  $SD = 1.7$ ) and reported an average of 14 years of education. Across samples, the majority of participants were white (CP-IGT = 63%, CP+IGT = 58%, NP = 57%), female (CP-IGT = 71%, CP+IGT = 73%, NP = 70%), single (CP-IGT = 86%, CP+IGT = 77%, NP = 87%), and reported an annual family income of over \$50,000 a year (CP-IGT = 61%, CP+IGT = 55%, NP = 49%). No significant between group differences were observed across any of these sociodemographic variables. Results of analyses comparing the CP-IGT, CP+IGT, and NP participants across sociodemographic variables are presented in Table 1.

For tests of the effect of pain status on *subjective* decision-making, academic achievement, and quality of life, the full sample of 133 CP participants was used. Due to the large discrepancy in sample size between the 133 CP participants and 260 NP participants, a matching procedure was employed to identify NP participants who matched CP participants across sociodemographic variables (Althausser & Rubin, 1970; Stuart, 2010). Univariate and chi-square analyses confirmed adequacy of the matching

procedure, these analyses revealing no significant differences between CP students and NP students on sociodemographic variables. The entire sample ranged in age from 18 to 24 years ( $M = 20.1$ ,  $SD = 1.6$ ) and reported a mean of 14.6 years of education (Range = 13-21,  $SD = 1.4$ ). The majority of the total sample of 266 participants were white (64%), female (75%), single (88%) and reported an annual family income of over \$50,000 a year (91%). Results of analyses comparing matched CP students and NP students on sociodemographic variables are presented in Table 2. No significant between group differences were observed across any of these sociodemographic variables.

For tests of the effect of pain status on *objective* decision-making, the sample of 33 CP participants who completed all measures including the IGT was used along with 33 matched NP participants. Univariate and chi-square analyses confirmed adequacy of the matching procedure, these analyses revealing no significant differences between CP and NP participants across sociodemographic variables. This sample ranged in age from 18 to 24 years ( $M = 20.1$ ,  $SD = 1.6$ ) and reported a mean of 14.5 years of education (Range = 13-17,  $SD = 1.3$ ). The majority of the total sample of 66 participants were white (58%), female (74%), single (83%) and reported an annual family income of over \$50,000 a year (52%). No significant between group differences were observed across any of these sociodemographic variables. Results of analyses comparing this sample of matched CP and NP participants on sociodemographic variables are presented in Table 3.

## **Measures**

The Multidimensional Pain Inventory (MPI) is a 61-item inventory designed to assess participant's subjective experience and perception of pain and the effects of pain on functioning as well as the responses of significant others (MPI; Kerns, Turk, & Rudy,

1985). Questions are categorized into 13 scales (Pain severity, Interference, Life control, Affective distress, Support, Punishing responses, Solicitous responses, Distracting responses, Household chores, Outdoor work, Activities away from home, Social activities, and General activity level). Internal consistency estimates for the 13 scales range from .70-.90 and test-retest reliability estimates for these scales range from .62-.91 (Kerns et al., 1985). The Pain interference subscale ranges from 0-6 and was used as the measure of pain in all analyses. Nine of the 13 MPI scales are used to classify respondents into one of three coping groups: adaptive coper (AC), dysfunctional (DYS), and interpersonally distressed (ID). The AC group is characterized by lower levels of pain severity, perceived interference, and affective distress and higher levels of daily activity and life control. The ID group is characterized by a high report of interpersonal distress as evidenced by scores on the significant-other response and support scales. Finally, the DYS group is characterized by high pain severity and high pain interference, a higher degree of psychological distress, lower perceived ability to control their lives, and lower activity levels. MPI coping groups were used to provide a more nuanced description of CP study participants and the impact of their pain on multiple domains of function.

The pain awareness prime was an adapted version of a prime utilized by Henderson et al. (2009). Participants randomized to the pain awareness condition received the following instructions:

“In your own words, we would like you to think about the worst pain experience you have had and all that you had to deal with in relation to that pain experience. Feel free to write as much as you need and don’t worry about spelling and

grammar. Simply focus on using your own words to tell the story of your worst pain experience. Once you begin writing, we would like you to write continuously for at least 10 minutes, across the three questions.

A) As you write about the time when your pain experience was at its worst, describe its impact on your everyday functioning, including difficulties with physical health, work or school, relationships, overall quality of life, and emotions.

B) As you write about the time when your pain experience was at its worst, be sure to mention when your worst experience of pain occurred, when your pain started, and how long you tried to manage your pain.

C) As you write about the time when your pain experience was at its worst, describe the thoughts and actions you have used to deal with it and tell us how effective those thoughts and actions were in helping you to deal with the pain.”

The control prime instructions were also adapted from the control prime utilized by Henderson et al. (2009), which modified the awareness prime to ask about a recent shopping experience. Participants randomized to this control condition received the following instructions:

“In your own words, we would like you to think about a recent shopping experience you have had and all that you had to deal with in relation to that shopping experience. Feel free to write as much as you need and don’t worry about spelling and grammar. Simply focus on using your own words to tell the story of your recent shopping experience. Once you begin writing, we would like you to write continuously for at least 10 minutes, across the three questions.

A) As you write about your recent shopping experience, describe its impact on your everyday functioning, including physical health, work or school, relationships, overall quality of life, and emotions.

B) As you write about your recent shopping experience, be sure to mention when the shopping experience occurred, when you started shopping, and how long you shopped.

C) As you write about your recent shopping experience, describe the thoughts and actions you have used to deal with it and tell us how effective those thoughts and actions were in helping you to shop.”

The Numeric Rating Scale (NRS) was completed prior to and directly after completing the priming task. The NRS is an 11-point scale (0-10) used for the self-report of pain and has been commonly cited for its use in providing a check of various pain manipulation procedures (Ferreira-Valente, Pais-Ribeiro, & Jensen, 2011; Salaffi, Stancati, Silvestri, Ciapetti, & Grassi, 2004; Williamson & Hoggart 2005).

The Stroop task is a measure of attention in which the names of colors are presented either in the color denoted by the name (e.g., the word “red” presented in red ink) or in a color not denoted by the name (e.g., the word “red” presented in blue ink). Naming the color of words is usually associated with longer reaction times when the presentation color is something other than the color denoted by the name (Lezak, 2012; Stroop, 1935). This task was hosted online by Millisecond Software<sup>©</sup>. Attention has been found to negatively impact decision-making (Banks & Kerns, 1996; Eccleston, 1994; Kahneman, 2011; Ruder & Bless 2003), academic achievement (Fergusson & Horwood, 1992; Merrell & Tymms, 2001; Rabiner, Murray, Schmid, & Malone, 2004),

and quality of life (Danckaerts et al. 2010). Inclusion of Stroop scores allowed for the examination of the potential relation of attention to these study-relevant outcome variables (i.e., decision-making, academic achievement, and quality of life).

The Depression Anxiety and Stress Scales – 21 (DASS-21) is a 21-item self-report measure that consists of three 7-item scales of depression, anxiety, and stress (Henry & Crawford, 2005). A four-point severity scale measures the extent to which each state has been experienced over the past week. Items for the DASS -21 come from the original DASS (Lovibond & Lovibond, 1995). The DASS -21 is ideal for the assessment of depression among persons with chronic pain, as the depression scale does not include somatic items, preventing overlap with the Patient Health Questionnaire – 15 and artificial inflation of depression by pain symptoms (Nicholas & Asghari, 2006). The reliability and validity of the DASS has been well-established (Antony, Bieling, Cox, Enns, & Swinson, 1998; Taylor, Lovibond, Nicholas, Cayley, & Wilson, 2005). Overall scores on this measure range from 0-63, with higher scores indicating greater mood disturbance. Mood has been found to negatively impact attention (Ellenbogen, Schwartzman, Stewart, & Walker, 2002; Gendolla, Abele, Andrei, Spurk, & Richter, 2005), decision-making (Kahneman, 2011; Ruder & Bless 2003) and quality of life (Goulia, Voulgari, Tsifetaki, Drosos, & Hyphantis 2010; Kroenke, Outcalt, Krebs, Bair, Wu, Chumbler, & Yu, 2013; Orenius, Koskela, Koho, Pohjolainen, Kautiainen, Haanpää, Hurri, 2012; Outcalt, Kroenke, Krebs, Chumbler, Wu, Yu, & Bair, 2015; Wong, Lam, Chow, Chen, Lim, Wong, & Fielding, 2014). Inclusion of DASS-21 scores allowed for the examination of the potential relation of mood to these study-relevant outcome variables (i.e., decision-making, academic achievement, and quality of life).

The Patient Health Questionnaire – 15 (PHQ-15) is a 15 item self-report measure of somatization (Kroenke, Spitzer, & Williams, 2002). Each symptom is given a score from 0 (“not bothered at all”) to 2 (“bothered a lot”). This list of items was taken from the Patient Health Questionnaire – MD (Kroenke, Spitzer, DeGruy, & Swindle, 1998; Spitzer, Kroenke, & Williams, 1999), which is a diagnostic tool assessing five different mental health disorders. The PHQ-15 evidences preliminary data for reliability and validity (Kroenke, Spitzer, & Williams, 2002; Interian, Allen, Gara, Escobar, & Díaz-Martínez, 2006). Overall scores on this measure range from 0-30, with higher scores indicating greater somatization. Somatization has been found to occur in a population of persons with chronic pain anywhere from 0%-53% (Birket-Smith, 2001; Fishbain, Goldberg, Meagher, Steele, & Rosomoff, 1986). Inclusion of PHQ-15 scores allowed for the examination of the potential relation of somatization to study-relevant outcome variables (i.e., decision-making, academic achievement, and quality of life).

The Iowa Gambling Task (IGT) is an *objective*, computerized task that measures risk in the context of decision-making (Bechara, Damásio, Damásio, & Anderson, 1994). This task was hosted online by Millisecond Software<sup>©</sup>. Four decks of cards are presented on the computer screen, and the participant is instructed to pick a card and try to make as much “money” as possible. Each card has a positive or negative monetary value. Unknown to the participant, two decks are “good” decks that produce small, but steady monetary gains. The remaining two decks are “bad” decks that produce some cards with large monetary gain, but more cards with monetary loss. Lower monetary sums at the end of the game are indicative of propensity for higher risk – more cards chosen from the “bad” decks than from the “good”. This task is commonly cited in the literature and used

to assess risk across various populations including clinically significant chronic pain (Apkarian et al. 2007), brain damage (Bechara et al., 1994; Bechara, 2004), substance use (Bartzokis, Lu, Beckson, Rapoport, Grant, Wiseman, et al., 2000; Bechara, 2003), psychopathology (Bark, Dieckmann, Bogerts, & Northoff, 2005; Cavallaro, Cavedini, Mistretta, Bassi, Angelone, Ubbiali et al., 2003), and human development (Carlson, 2005; Crone, Vendel, & Van der Molen, 2003; Denburg, Tranel, & Bechara, 2005). Performance on this measure was used as a dependent variable to establish the impact of pain and pain awareness on *objective* decision-making.

The Personal Risk Inventory (PRI) is a *subjective* measure of how everyday situations are assessed in terms of decision-making choices, and the perceived risks associated with different choices (Hockey, Maule, Clough, & Bdzola, 2000). Respondents are required to imagine themselves in various hypothetical everyday situations (scenarios) and make a choice between two options for each scenario, one risky and one safe. The measure includes 13 scenarios chosen to be representative of a wide range of situations (e.g., legal, health, social, moral, financial). The set of 13 scenarios evidenced a test-retest reliability of 0.63, and an adequate level of internal consistency (Hockey et al., 2000). Scores on this measure range from 0-130, with higher scores indicating riskier decision-making. Performance on this measure was used as a dependent variable to establish the impact of pain and pain awareness on *subjective* decision-making.

Academic achievement was measured by dividing participant GPA by year in school to provide a weighted score. This was done to account for differing accumulation of credit hours given year in college (i.e., a 1st year freshman GPA of 3.2 is not equal to a

4th year senior GPA of 3.2). This resulted in weighted scores ranging from 0.53 – 3.85, with lower values indicating better academic achievement. These scores were used as an outcome variable in analyses examining academic achievement.

The WHOQOL-BREF is a 26-item assessment of quality of life (WHOQOL Group, 1998). Items for the WHOQOL-BREF were selected from the WHOQOL-100 and assess quality of life across four domains: physical, psychological, social, and environment, providing a total quality of life score. The WHOQOL-BREF evidenced good discriminant validity and adequate construct validity. Psychometric properties of this measure have been obtained through surveys of adult populations both physically healthy and unhealthy, inpatient and outpatient, and across 23 countries (Skevington, Lotfy, & O'Connell, 2004). Scores on this measure range from 0-100, with higher scores indicating report of greater quality of life. The scores obtained on this measure were used as an outcome variable in analyses examining quality of life.

### **Procedure**

Participant flow through the study is depicted in Figure 1. Participants accessed the web-based consent form hosted on the Qualtrics survey site. Participants completed the consent form, and then answered questions to determine eligibility for participation in the study. Before beginning the study, participants were reminded to allow 60-90 minutes for participation. They were also asked to take the study at a later time if they had just taken prescription medications, or if they were under the influence of alcohol or illicit drugs. Qualtrics randomly assigned both CP and NP participants into completing either the pain awareness prime or control writing task. This process resulted in the creation of four groups: 1) CP/pain aware, 2) CP/control, 3) NP/pain aware, and 4)

NP/control. All study measures were hosted through Qualtrics, with the exception of the Stroop and Iowa Gambling Task, which were hosted by Millisecond Software<sup>©</sup>. Prior to filling out study measures, participants were asked to use a web browser that would be compatible with accessing the measures through Millisecond Software<sup>©</sup>. All participants completed measures assessing sociodemographic, medical history, current health behavior, pain, mood, attention, academic performance, and quality of life. Participants then provided a rating of current pain on the NRS and completed either the pain awareness prime or control writing task. Following the writing task, participants again provided a rating of current pain using the NRS and completed questions from the Personal Risk Inventory (PRI) and the Iowa Gambling Task (IGT). At the end of the online survey, participants were asked to submit their email address if they would like to be entered into a lottery to win a \$100 Amazon gift card. Participants were also asked to disclose if they felt they had given their best effort in completing all study measures.

### **Data Screening and Statistical Analysis**

The SPSS System (Version 22) for Windows (SPSS, 2014) was used for all analyses. A significance level of  $\alpha = .05$  was used to evaluate the strength of between-groups comparisons. Independent *t*-tests for continuous variables and chi-square tests for categorical variables were used to test for differences between CP participants who completed all measures except for the IGT and CP participants who completed all measures including the IGT on demographic variables and pain sites. Prior to conducting primary analyses, relevant sociodemographic, academic, quality of life, pain, mood, attention, and decision-making variables were examined for accuracy of data entry, missing values, univariate outliers, and normality of distribution (Tabachnick & Fidell,

2013). Univariate analyses did not reveal significant skewness (i.e., skewness > 2.00) and/or kurtosis (i.e., kurtosis > 2.00) for variables relevant to the primary analyses.

Procedures were then used to identify univariate outliers (i.e., examination of z-scores) and multivariate outliers (i.e., examination of Mahalanobis' distance and leverage scores).

No univariate or multivariate outliers were detected; therefore, no cases were deleted.

Two-by-two analyses of variance (ANOVA) and covariance (ANCOVA) were planned to test the combined effects of pain status (CP, NP) and pain awareness (pain aware, control) on risky decision-making. Testing the combined impact of pain status and pain awareness on decision-making first required confirmation of the effectiveness of the priming task. Independent samples *t*-tests were employed to determine if participants in the pain aware condition evidenced greater change in report of pain post-prime task than participants in the control condition. There was no significant difference in change scores between the pain aware and control conditions for either the CP or NP participant groups. Results of analyses comparing CP and NP participants across pain aware and control prime conditions are presented in Table 4. There was also no significant difference between the CP and NP pain aware and control groups in the average minutes spent writing, with average writing times being 7.2 to 8.5 minutes, respectively. Because there was not a significant difference between pain aware and control groups in writing time, the failure of the priming task could not be explained by different levels of task engagement across the groups. Because the priming task did not result in a significant increase in pain ratings the decision was made to employ one-way ANOVA/ANCOVAs to test the effect of pain status (CP, NP) on *subjectively* and *objectively* measured risky decision-making.

A one-way ANOVA was performed to test the effect of pain status (CP, NP) on academic achievement. A one-way ANCOVA was planned to test the effect of pain status (CP, NP) on quality of life. Based on the examination of correlations among theoretically indicated variables and quality of life, age and mood were indicated to be entered into the model as covariates. However, heterogeneity of regression was observed, rendering mood unacceptable as a covariate. Rather than excluding this variable from analyses, the decision was made to transform mood as a continuous variable into a grouping variable, using the sample-specific median value for reporting low mood disturbance (13 or lower) or high mood disturbance (greater than 14). Therefore, a 2x2 (pain status by mood) ANCOVA was utilized to test the interactive effect of pain status and mood on quality of life. Hierarchical multiple regression analyses were utilized to assess relative strength of pain, mood, and *subjectively* or *objectively* measured decision-making to academic achievement and quality of life within the CP participant sample that completed all study measures including the IGT.

Post-hoc analyses utilizing the MPI coping profile classifications described by Turk and Rudy (1988) were employed to more closely examine study findings related to the impact of non-clinical chronic pain on decision-making, academic achievement, and quality of life. In order to be classified into a coping group, participants must endorse that they have a significant other. Out of the total 133 CP participants, 53 participants endorsed having a significant other and were categorized into one of three coping groups: adaptive (AC,  $n = 19$ ), dysfunctional (DYS,  $n = 15$ ), and interpersonally distressed (ID,  $n = 19$ ). One-way ANOVA/ANCOVAs were then utilized to examine group differences in *subjective* decision-making, academic achievement, and quality of life across AC

participants ( $n = 19$ ), DYS participants ( $n = 15$ ), ID participants ( $n = 19$ ), and a group of randomly selected NP participants ( $n = 19$ ) from the matched sample.

Out of the 33 CP participants who completed all study measures including the IGT, 17 participants endorsed having a significant other and were categorized into one of three coping groups: adaptive (AC,  $n = 10$ ), dysfunctional (DYS,  $n = 5$ ), and interpersonally distressed (ID,  $n = 2$ ). One-way ANOVAs were then utilized to examine group differences in *objective* decision-making across AC participants ( $n = 10$ ), a combined group of DYS and ID (DYS+ID) participants ( $n = 7$ ), and a group of randomly selected NP participants ( $n = 10$ ) from the matched sample. One-way ANOVAs were also utilized to examine the impact of pain status (CP, NP) on MPI scales related to coping, including the life control (LC), affective distress (AD), support (S), and general activity level (GAL) scales within the full CP sample. Further, the effect of AC, DYS, ID, and NP participant groups on the LC, AD, S, and GAL scales was explored.

## Results

Participants accessing the online surveys included 133 CP students who completed all measures through Qualtrics, while 33 of these CP students completed all measures through both Qualtrics and Millisecond Software<sup>®</sup> (i.e., the IGT). Independent *t*-tests for continuous variables and chi-square tests for categorical variables were used to test for differences between CP participants who completed all measures except for the IGT and CP participants who completed all measures including the IGT. There were no significant differences in sociodemographics or location of pain sites between CP participants who completed all measures except for the IGT and CP participants who completed all measures including the IGT. Results of analyses comparing CP

participants who completed all measures except for the IGT and CP participants who completed all measures including the IGT on sociodemographic variables and pain sites are presented in Table 5. No significant between group differences were observed.

Correlational analyses were performed to test the relations among sociodemographic, mood, pain, decision-making, academic achievement, and quality of life variables for all CP participants and CP participants who completed all measures including the IGT. Attention was not a variable included in correlational analyses for all CP participants who completed all measures except for the IGT. For both groups, mood and somatization were found to be significantly correlated with quality of life. As mood and somatization were highly correlated and the empirical literature indicates mood to be greatly related to quality of life (Goulia, Voulgari, Tsifetaki, Drosos, & Hyphantis 2010; Kroenke, Outcalt, Krebs, Bair, Wu, Chumbler, & Yu, 2013; Orenius, Koskela, Koho, Pohjolainen, Kautiainen, Haanpää, Hurri, 2012; Outcalt, Kroenke, Krebs, Chumbler, Wu, Yu, & Bair, 2015; Spitzer et al., 1995; Wong, Lam, Chow, Chen, Lim, Wong, & Fielding, 2014), only mood was included in all future analyses. Results of correlational analyses testing associations among sociodemographic, mood, pain, decision-making, academic achievement, and quality of life variables for all CP participants and CP participants who completed all measures including the IGT are presented in Tables 6 and 7.

### **The Effect of Pain Status on *Subjectively* Measured Risky Decision-Making**

Because the priming task did not result in a significant increase in pain ratings, the decision was made to employ a one-way ANCOVA to test the effect of pain status (CP, NP) on *subjectively* measured risky decision-making within the sample of 133 CP

participants who completed all measures relevant to this analysis and a matched sample of 133 NP participants. Based on the examination of correlations among theoretically indicated variables and risky decision-making, ethnicity was entered into the model as a covariate. After controlling for the effect of ethnicity, there was no significant effect of pain status on *subjectively* measured risky decision-making. Means, standard deviations, and univariate  $F$  value for the relation of pain status to *subjectively* measured risky decision-making are presented in Table 8. Figure 2 shows the hypothesized and observed relation of pain status to *subjectively* measured risky decision-making.

### **The Effect of Pain Status on *Objectively* Measured Risky Decision-Making**

Because the priming task did not result in a significant increase in pain ratings, the decision was made to employ a one-way ANOVA to test the effect of pain status (CP, NP) on *objectively* measured risky decision-making within the sample of 33 CP participants who completed all measures relevant to this analysis and a matched sample of 33 NP participants. . There was no significant effect of pain status on *objectively* measured risky decision-making. Means, standard deviations, and univariate  $F$  value for the relation of pain status to *objectively* measured risky decision-making are presented in Table 10. Figure 3 shows the hypothesized and observed relation of pain status to *objectively* measured risky decision-making.

### **The Effect of Pain Status on Academic Achievement**

A one-way ANOVA was performed to test the effect of pain status (CP, NP) on academic achievement within the sample of 133 CP participants who completed all measures relevant to this analysis and a matched sample of 133 NP participants. A significant effect of pain status on academic achievement was revealed,  $F(1, 264) = 4.5$ ,

$p = 0.03$ , with the CP group evidencing poorer academic achievement than the NP group. Adjusted means, standard deviations, and univariate  $F$  value for the relation of pain status to academic achievement are presented in Table 8. Figure 3 shows the hypothesized and observed relation of pain status to academic achievement.

### **The Effect of Pain Status on Quality of Life**

Using the sample of the 133 CP participants who completed all measures relevant to this analysis and a matched sample of 133 NP participants, a 2x2 ANCOVA was performed to test the interactive effect of pain status (CP, NP) and mood (low, high) on quality of life, with age entered as a covariate in the model. After controlling for the effect of age, there was a significant interactive effect of pain status and mood on quality of life,  $F(1, 264) = 4.3, p = .04$ . Adjusted means, standard deviations, and  $F$  value for the interactive effect of pain status and mood to quality of life are presented in Table 9. Figure 4 shows the interactive effect of pain status and mood on quality of life, with the interaction of low mood and chronic pain being related to significantly poorer quality of life.

### **The Influence of Pain, Mood, and Decision-Making on Academic Achievement**

**The influence of pain, mood, and *subjectively* measured risky decision-making on academic achievement.** Hierarchical multiple regression analysis was utilized to assess relative strength of sociodemographics, pain, mood, and *subjectively* measured risky decision-making in the prediction of academic achievement scores for the 133 CP participants who completed all measures relevant to this analysis. The full model predicting academic achievement was significant  $F(7, 125) = 20.0, p < .001$ , and accounted for 60% of the variance in this domain. However, sociodemographics

accounted for 60% of the variance in academic achievement. Pain, mood, and subjectively measured risky decision-making did not account for significant additional proportions of variance in academic achievement after accounting for the variance in this domain due to sociodemographics. Results of the hierarchical multiple regression analysis are presented in Table 11.

**The influence of pain, mood, and *objectively* measured risky decision-making on academic achievement.** Hierarchical multiple regression analysis was utilized to assess relative strength of pain, mood, and *objectively* measured risky decision-making in the prediction of academic achievement scores for the 33 CP participants who completed all measures relevant to this analysis. The full model predicting academic achievement was not significant,  $F(3, 29) = 0.38, p = .77$ , and accounted for 2% of the variance in this domain. Results of the hierarchical regression analysis are presented in Table 12. Pain, mood, and *objectively* measured decision-making did not account for significant proportions of variance in academic achievement. . Results of the hierarchical multiple regression analysis are presented in Table 12.

### **The Influence of Pain, Mood, and Decision-Making on Quality of Life**

**The influence of pain, mood, and *subjectively* measured risky decision-making on quality of life.** Hierarchical multiple regression analysis was utilized to assess relative strength of sociodemographics, pain, mood, and *subjectively* measured risky decision-making in the prediction of quality of life scores for the sample of 133 CP participants who completed the measures relevant to this analysis. The full model predicting quality of life was significant,  $F(7, 125) = 11.3, p < .001$ , and accounted for 46% of the variance in this domain. However, only mood made a separate and unique

contribution to the variance in quality of life scores, accounting for 46% of the variance in this domain. *Subjectively* measured risky decision-making did not account for significant additional proportions of variance in quality of life after accounting for the variance in this domain due to mood. Results of the hierarchical multiple regression analysis are presented in Table 11.

**The influence of pain, mood, and *objectively* measured risky decision-making on quality of life.** Hierarchical multiple regression analysis was utilized to assess relative strength of pain, mood, and *objectively* measured risky decision-making in the prediction of quality of life for the 33 CP participants who completed all measures relevant to this analysis. The full model predicting quality of life was significant,  $F(3, 29) = 5.88, p < .01$ , and accounted for 38% of the variance in this domain. Results of the hierarchical regression analysis are presented in Table 12. Mood accounted for 36% of the variance in quality of life. Neither pain nor *objectively* measured risky decision-making accounted for significant additional proportions of variance in quality of life after accounting for the variance in this domain due to mood.

### **Post-hoc Analyses**

**Relation of pain status and MPI coping group to relevant outcome variables.** Post-hoc analyses were utilized to further investigate the relation of pain status and MPI coping group to *subjectively* measured risky decision-making, academic achievement, and quality of life using the sample of AC = 19, DYS = 15, and ID = 19 CP participants who completed all measures relevant to this analysis and a matched sample of 19 NP participants. The relation of pain status and MPI coping group to *objectively* measured risky decision-making was examined using the sample of AC = 10 and DYS+ID = 7 who

completed all measures relevant to this analysis and a matched sample of 10 NP participants.

***The effect of NP and MPI coping group on subjectively measured risky decision-making.*** A one-way ANOVA was performed to test the effect of NP and MPI coping group (AC, DYS, ID) on *subjectively* measured risky decision-making. This analysis was then repeated to test the effect of NP and MPI coping group (AC, DYS, ID) on *subjectively* measured risky decision-making. There was no significant effect of NP and MPI coping group (AC, DYS, ID) on *subjectively* measured risky decision-making. There was a significant effect of MPI coping group on *subjectively* measured risky decision-making,  $F(2, 69) = 3.6, p = 0.04$ . Post-hoc comparisons using the Tukey HSD test indicated that the DYS group made less risky decisions than the ID group, while the AC group did not differ from either the DYS or ID groups. Means, standard deviations, and univariate  $F$  value for the relation of MPI coping groups (AC, DYS, ID) to *subjectively* measured risky decision-making are presented in Table 13.

***The effect of NP and MPI coping group on academic achievement.*** A one-way ANOVA was performed to test the effect of NP and MPI coping group (AC, DYS, ID) on academic achievement. This analysis was then repeated to test the effect of MPI coping group (AC, DYS, ID) on academic achievement. There was no significant effect of NP and/or MPI coping group (AC, DYS, ID) on academic achievement.

***The effect of NP and MPI coping group on quality of life.*** A one-way ANCOVA was performed to test the effect of NP and MPI coping group (AC, DYS, ID) on quality of life. This analysis was then repeated to test the effect of MPI coping group

(AC, DYS, ID) on quality of life. After controlling for the effect of mood, there was no significant effect of NP and/or MPI coping group (AC, DYS, ID) on quality of life.

***The effect of NP and MPI coping group on objectively measured risky decision-making.*** A one-way ANOVA was performed to test the effect of NP and MPI coping group (AC, DYS+ID) on *objectively* measured risky decision-making. This analysis was then repeated testing the effect of MPI coping group (AC, DYS+ID) on *objectively* measured risky decision-making. There was no significant effect of NP and/or MPI coping group (AC, DYS+ID) on *objectively* measured risky decision-making.

**Relation of pain status and MPI coping group on MPI scales related to coping.**

***The effect of pain status on MPI scales related to coping.*** Post-hoc analyses were utilized to further investigate the relation of pain status to scales related to coping on the MPI using the sample of the 133 CP participants who completed all measures relevant to this analysis and a matched sample of 133 NP participants. One-way ANOVAs were performed to test the effect of pain status (CP, NP) on LC, AD, S, and GAL scales. There was no significant effect of pain status on either the LC or GAL scales. There was a significant effect of pain status on the AD scale,  $F(1, 264) = 21.1, p < .001$ , with the CP participants reporting more affective distress than NP participants. There was also a significant effect of pain status on the S scale,  $F(1, 264) = 36.0, p < .001$ , with the CP participants reporting more support than NP participants. Means, standard deviations, and univariate  $F$  values for the relation of pain status to MPI Coping Scales are presented in Table 14.

***The effect of NP and MPI coping profile group on MPI scales related to coping.*** Post-hoc analyses were utilized to further investigate the relation of pain status and MPI

coping group to MPI scales related to coping using the sample of AC = 19, DYS = 15, and ID = 19 participants who completed all measures relevant to this analysis and a matched sample of 19 NP participants. One-way ANOVAs were performed to test the effect of NP and MPI coping group (AC, DYS, ID) on LC, AD, S, and GAL scales. There was a significant effect of NP and MPI coping group (AC, DYS, ID) on the LC scale,  $F(3, 68) = 4.1, p = 0.01$ . Post-hoc comparisons using the Tukey HSD test indicated that the AC group reported significantly more life control than the DYS group. There was a significant effect of NP and MPI coping group (AC, DYS, ID) on the AD scale,  $F(3, 68) = 22.3, p < .001$ . Post-hoc comparisons using the Tukey HSD test indicated that the ID and DYS groups reported significantly more affective distress than either the AC or NP groups. There was a significant effect of NP and MPI coping group (AC, DYS, ID) on the S scale,  $F(3, 68) = 23.5, p < .001$ . Post-hoc comparisons using the Tukey HSD test indicated that the ID group reported significantly more support than the NP, AC, and DYS groups.

There was no significant effect of NP and MPI coping group (AC, DYS, ID) on the GAL scale. A one-way ANOVA was utilized to test the effect of only MPI coping group on the GAL scale. There was no significant effect of MPI coping group (AC, DYS, ID) on the GAL scale. Means, standard deviations, and univariate  $F$  value for the relation of NP and MPI coping group (AC, DYS, ID) to LC, AD, S, and GAL MPI scales related to coping are presented in Table 15.

### **Discussion**

The present study sought to examine the relation of non-malignant chronic pain and pain awareness to risky decision-making, academic achievement, and quality of life

among a population of college students aged 18 to 24. As results did not reveal a significant difference in pain awareness between pain aware and control groups, the interactive effect of pain awareness and pain status on risky decision-making could not be examined. Analyses revealed that students with chronic pain did not significantly differ from students without pain in *subjectively* or *objectively* measured risky decision-making. Students with chronic pain did report significantly lower academic achievement than students without pain. Also, mood was found to interact with pain status such that students with chronic pain who reported high mood disturbance also reported significantly poorer quality of life. The independent and additive contributions of pain, mood, and risky decision-making to academic achievement and quality of life among students with chronic pain were also examined. An overall model predicting academic achievement was significant, however, sociodemographics explained the majority of the variance in this domain, with only age making an independent and unique contribution. The overall models predicting quality of life were significant, however, only mood was found to make an independent and unique contribution to quality of life.

An original aim of the present study was to examine the impact of pain awareness on risky decision-making. Methods that have been used to elicit pain in a non-pain population include electrical stimulation, thermal heat, and cold pressor tasks (Crombez, Eccleston, Baeyens, & Eelen, 1996; deWeid & Verbaten, 2001; Moore, Keough, & Eccleston, 2012; Rowe et al., 2012; Vancleef & Peters, 2006; Zeidan, Gordan, Merchant, & Goolkasian, 2009). While writing has been successfully employed in past studies to prime awareness of illness and mood (Henderson, Orbell, & Hagger, 2009; Martin & Alexeeva, 2010; Ruder & Bless, 2003; Storbeck & Clore, 2008), results of the current

study indicated that writing about a painful experience did not result in a significant increase in pain awareness. This may have been because the population sampled – college students with chronic pain – have to maintain functioning in the face of pain in order to engage in collegiate activities. Post-hoc analyses revealed that activity level did not differ between students with and without chronic pain. This suggests that college students with chronic pain may have developed a skill set for ignoring pain in order to continue to engage in activities at a rate equal to their non-pain peers. This skill may be considered functional to the extent that it allows college students to engage in activities despite pain. However, this strategy has the potential to become problematic if college students with chronic pain over-engage in specific activities, resulting in impaired functioning in other life domains.

The findings from the present study indicated that pain status did not influence risky decision-making. This finding is inconsistent with the one published study where a clinical population of persons with chronic pain engaged in riskier *objectively* measured decision-making than their non-pain peers (Apkarian et al., 2007). The results reported by Apkarian et al. (2007) and the results of the present study may indicate important neuropsychological differences between clinical and non-clinical chronic pain populations that warrant further investigation. There is much evidence supporting that executive functioning, attention, and memory is impaired in a clinical population of persons with chronic pain (for reviews, see Berryman, Stanton, Bowering, Tabor, McFarlane, & Moseley, 2013; Berryman, Stanton, Bowering, Tabor, McFarlane, & Moseley, 2014; Liu, Li, Tang, Wu, & Hu, 2014). Additionally, research on brain imaging show structural brain changes in a clinical population of persons with chronic

pain (Apkarian, Hashmi, & Baliki, 2011; May, 2011; Smallwood et al., 2013). However, there is a lack of research examining neurocognitive functioning and brain imaging of a non-clinical population with chronic pain.

Results from the present study revealed an influence of pain status on academic achievement. Two studies examining teacher report of academic achievement of children and adolescents with chronic pain reveal conflicting findings (Logan et al., 2008; Vervoort, Logan, Goubert, De Clercq, & Hublet, 2014). The present study lends support to the fact that chronic pain, even at the non-clinical level, impacts academic functioning. This is important, as previous studies suggest that unemployment in the context of chronic pain is associated with lower educational level (Abasolo et al., 2012; Coggon et al., 2013; Gerdle, Björk, Henriksson, & Bengtsson, 2004; Moulin, Clark, Speechley, & Morley-Forster, 2002; Olaya-Contreras, & Styf, 2013). Therefore, obtaining a college degree may be a factor that protects against future unemployment. A model including pain, mood, and *subjectively* measured risky decision-making predicted a significant amount of the variance in academic achievement; however, this variance was accounted for by sociodemographic factors. Post-hoc analyses did not reveal a significant difference in MPI pain coping profile on academic achievement but did reveal that students with and without chronic pain did not differ with regard to general activity level and life control. It may be the case that in allotting time and energy resources to maintaining academics, students with chronic pain are suffering losses across other life domains as well. This suggests that students with chronic pain, no matter their coping style, may benefit from skills aimed at balancing activities and academics in order to optimize functioning across life domains.

The current study revealed that students with chronic pain who reported greater mood disturbance reported poorer quality of life than students with and without chronic pain who reported less mood disturbance. Additionally, a model including relevant sociodemographics, pain, mood, and *subjectively* measured risky decision-making revealed that mood was the only variable to make a separate and unique contribution to the variance in quality of life for students with chronic pain. After controlling for the effect of mood, post-hoc analyses examining the impact of MPI coping profile to quality of life did not reveal significant differences across profiles. Literature supports the relation of mood to quality of life in the context of chronic pain (Goulia, Voulgari, Tsifetaki, Drosos, & Hyphantis, 2010; Kroenke et al., 2013; Orenius et al., 2012; Outcalt et al., 2015; Wong et al., 2014). The relation of mood to quality of life is an important finding, as depression, anxiety, and stress are already prevalent for a typical college population (Bayram & Bilgel, 2008; Beiter et al., 2015; Eisenberg, Gollust, Golberstein, & Hefner, 2007; Lipson, Gaddis, Heinze, Beck, & Eisenberg, 2015; Stewart-Brown et al., 2000) as well as for general populations with chronic pain (McWilliams et al., 2003; Scott et al., 2009). The findings of the current study suggest that a non-clinical population of college students with chronic pain is at greater risk than a general college population for psychiatric diagnosis. The results of this study reveal a need to screen college students with chronic pain for symptoms of mood disturbance, as well as provide skills for prevention of mood disturbance as well as skills for treatment of mood disturbance for college students with chronic pain.

Post-hoc analyses examining the impact of MPI coping group on MPI scales related to coping confirmed coping differences across groups, with AC copers exhibiting

more life control, DYS and ID copers exhibiting more affective distress, and ID copers exhibiting more support. However, no significant difference of coping group on academic achievement or quality of life was revealed, even though students with chronic pain reported poorer academic achievement and quality of life. Interestingly enough, the coping groups did not differ with regard to general activity level. Additionally, while students with chronic pain reported more support and affective distress than their non-pain peers, the two groups did not differ with respect to life control or general activity level. Taken together, these results suggest that while students with chronic pain may look the same as their non-pain peers in terms of activity engagement, their academics and quality of life are suffering. While students with chronic pain do not evidence riskier decision-making than their peers, the results of the current study suggest that students with chronic pain may be investing a differentially high amount of their resources in performing well academically and, subsequently, these students may be experiencing suboptimal engagement and performance across other life domains, and the stress incurred by their choice of resource allotment may be impacting their mood and overall quality of life. These findings highlight the need for services aimed at helping students with chronic pain balance their functional resources as well as prevent and treat mood disturbance in order to maintain quality of life.

### **Study Strengths and Limitations**

The current study evidences a number of strengths. This is the first study to examine risky decision-making within a non-clinical sample of persons with chronic pain. The sample consisted of college students aged 18 to 24, which allowed for the examination of the relation of chronic pain to risky decision-making, academic

achievement, and quality of life in an age and life circumstance where prevention of initial or further injury could save a significant amount of money and personal distress over a lifetime. The inclusion of both the PRI and IGT as measures of decision-making provided information regarding both *subjective* and *objective* risky decision-making. Finally, the present study revealed findings of import to providing effective services to college students with chronic pain. First, students with chronic pain evidence poorer academic achievement, while exhibiting similar activity levels to their non-pain peers. Second, an interactive effect of pain and mood on the quality of life of college students with chronic pain was revealed. Taken together, these findings suggest that screening and treating mood disturbance in this population may help in preserving quality of life. Additionally, as students with chronic pain may be expending much of their limited time and energy resources on maintaining academics, other life domains may also be suffering, contributing to the overall loss of quality of life and suggesting that students with chronic pain may benefit from skills aimed at balancing resources across life domains.

While the current study evidences several strengths, certain limitations must be acknowledged. The impact of pain awareness could not be examined due to the reduced effectiveness of the pain awareness prime task. While the online nature of the current study improved its accessibility and reach, the online presentation of materials also reduced control of environmental distractions (e.g., cell phone, on-line chats, roommates), which may have decreased the impact of the pain narrative on pain awareness. Additionally, there was reduced engagement with the Stroop and IGT tasks. As with the writing task, students may have not devoted their full attention to the online

tasks, missing instructions for completion of certain measures. This resulted in a small number of participants available for investigating the relation of pain status to *objectively* measured decision-making. However, a larger number of participants was available for investigating the relation of pain status to *subjectively* measured decision-making. While the sample size of students with chronic pain in the present study limited the power to reveal significant differences across non-pain and MPI coping groups, matching the chronic pain students to non-pain students provided adequate control for analyses examining impact of pain status (chronic pain, non-pain) on risky decision-making, academic achievement, and quality of life.

### **Future Directions**

The present study findings suggest that, within a non-clinical sample of college students, chronic pain does not negatively impact risky decision-making. Future studies examining neuropsychological testing and brain imaging among a non-pain sample, a non-clinical chronic pain sample, and a clinical chronic pain sample would help to elucidate the relation of executive functioning, memory, concentration, and structural changes in the brain that either proceed or result from the experience of chronic pain. Extending this line of research across coping profiles within clinical and non-clinical chronic pain populations may also lend important evidence to if changes in the brain are related to coping style.

The present study findings also indicate that, while college students with chronic pain report life control and general activity level equal to that of their non-pain peers, chronic pain negatively impacts academic achievement as well as quality of life. The findings of the present study call for further examination of college students with chronic

pain. Dividing the chronic pain and non-pain students into groups with and without significant symptoms of depression, anxiety, and stress would help to clarify the separate roles of pain and mood disturbance to quality of life. As students with chronic pain may be investing a differentially high amount of their resources in performing well academically, future studies of college students with chronic pain should assess perceived satisfaction with functioning across other life domains (e.g., health, social, financial, spiritual, occupational, leisure). Inclusion of persons aged 18 to 24 with and without chronic pain who are not in college, but who are either employed or unemployed, would also help to clarify the impact of chronic pain on risky decision-making and quality of life across different life circumstances. Finally, recruiting a larger participant sample would allow for further clarification of MPI coping groups to decision-making, academic achievement, and quality of life.

Prior to replication of the present study, shortcomings of the priming task should be addressed. It may be beneficial to conduct preliminary testing to compare different online modalities of priming for pain awareness (e.g., viewing pictures of people with injuries in pain, listening to a pain narrative). Participants may also be instructed to minimize outside distractions by turning off their cell phones, refraining from opening other internet browser windows, and completing the study measures in an environment where they are not likely to be disturbed by others. While the present study offered entry into a lottery for a gift card, offering a per person incentive for participation would likely aid recruitment and decrease dropout rates.

## Conclusions

Chronic pain is a condition that impacts approximately one-third of the US population (Johannes et al., 2010) and incurs health care costs ranging from \$261-\$300 billion (Gaskin & Richard, 2012). College students aged 18 to 21 are statistically more likely to experience the deleterious health outcomes that often occur as a result of risky decision-making (Mulye, Park, Nelson, Adams, Irwin, & Brindis, 2009). Findings from the current study make a significant contribution to the chronic pain and decision-making literature by: 1) providing preliminary evidence that chronic pain in a non-clinical population of college students does not result in riskier decision-making than a typical non-pain college population; 2) suggesting that while college students with chronic pain report life control and general activity levels similar to their non-pain peers, they also report poorer academic achievement and quality of life than their non-pain peers; 3) revealing that lower quality of life is predicted by mood, and not pain or either *objective* or *subjective* risky decision-making, and 4) suggesting that students with chronic pain may be investing a differentially high amount of their resources in performing well academically, ultimately leading to losses across other life domains and contributing to the overall loss of quality of life. The present study highlights that college students with chronic pain are in need of services to help with balancing resource allotment across life domains, as well as interventions targeted at preventing and decreasing depression, anxiety, and stress. Future studies are needed to continue to clarify the relation of chronic pain to risky decision-making, academic achievement, and quality of life in order to inform interventions to help prevent further impairment and disability for individuals with chronic pain.

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Table 1

*Descriptive Statistics for Sociodemographic Variables by Group*

Variable	Group			<i>p</i>
	CP Without IGT ( <i>n</i> = 100)	CP With IGT ( <i>n</i> = 33)	NP ( <i>n</i> = 260)	
Age	20.0 (1.7)	20.3 (1.7)	20.1 (1.7)	0.41
Annual Family Income				0.64
0 – 9,999	2.0%	3.0%	3.5%	
10,000 – 19,000	12.0%	15.2%	6.2%	
20,000 – 29,000	5.0%	6.1%	6.2%	
30,000 – 39,000	9.0%	6.1%	8.5%	
40,000 – 49,000	3.0%	6.1%	13.5%	
50,000 and Greater	61.0%	54.5%	48.5%	
Unknown	8.0%	9.1%	13.8%	
Education (Total Years)	14.2 (1.3)	14.5 (1.3)	14.5 (1.6)	0.37
Ethnicity				0.26
African American	5.0%	3.0%	4.6%	
American Indian or Alaskan	0.0%	0.0%	1.9%	
Asian or Pacific Islander	12.0%	15.2%	15.0%	
Caucasian	63.0%	57.6%	57.3%	
Hispanic	19.0%	24.2%	17.7%	
No Response	1.0%	0.0%	3.5%	
Gender (Female)	71.0%	72.7%	70.4%	0.44

Marital Status				0.98
Divorced	0.0%	0.0%	0.4%	
Engaged	2.0%	3.0%	2.7%	
Living Together	10.0%	9.1%	6.5%	
Married	2.0%	6.1%	1.9%	
No Response	0%	0.0%	1.9%	
Single	86.0%	77.1%	86.5%	

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*Note.* CP: pain lasting three months or longer that is not episodic, NP: no current acute pain, history of chronic pain, or episodic pain. Mean (Standard Deviation) presented for age and education.

Table 2

*Descriptive Statistics for Sociodemographic Variables for Matched Sample by Pain Status*

Variable	Group		<i>p</i>
	CP ( <i>n</i> = 133)	NP ( <i>n</i> = 133)	
Age	20 (1.7)	20 (1.7)	0.3
Annual Family Income (50,000 and Greater)	61%	45%	0.2
Education (Total Years)	14 (1.3)	15 (1.5)	0.4
Ethnicity (Caucasian)	63%	65%	0.8
Gender (Female)	71%	79%	0.4
Marital Status (Single)	86%	90%	0.5

*Note.* CP: pain lasting three months or longer that is not episodic, NP: no current acute pain, history of chronic pain, or episodic pain. Mean (Standard Deviation) presented for age and education.

Table 3

*Descriptive Statistics for Sociodemographic Variables for Matched Sample With Iowa Gambling Task by Pain Status*

Variable	Group		<i>p</i>
	CP ( <i>n</i> = 33)	NP ( <i>n</i> = 33)	
Age	20.3 (1.7)	19.9 (1.3)	0.1
Annual Family Income (50,000 and Greater)	54.5%	48.5%	0.2
Education (Total Years)	14.5 (1.3)	14.5 (1.3)	0.8
Ethnicity (Caucasian)	57.6%	57.6%	0.9
Gender (Female)	72.7%	75.8%	0.6
Marital Status (Single)	81.8%	84.8%	0.4

*Note.* CP: pain lasting three months or longer that is not episodic, NP: no current acute pain, history of chronic pain, or episodic pain. Mean (Standard Deviation) presented for age and education.

Table 4

*Pre- and Post Numeric Rating Score Means, Standard Deviation, and Univariate Statistics for Change Scores By Pain Status*

	Group				<i>t</i>	<i>p</i>
	Pain Awareness Prime		Control Prime			
	Pre (M, SD)	Post (M, SD)	Pre (M, SD)	Post (M, SD)		
CP	5.3 (1.8)	5.4 (1.7)	4.2 (1.9)	4.1 (2.0)	-0.87	.39
NP	1.7 (1.4)	2.0 (1.6)	1.2 (0.4)	1.2 (0.4)		

*Note.* CP: pain lasting three months or longer that is not episodic, NP: no current acute pain, history of chronic pain, or episodic pain.

Table 5

*Descriptive Statistics for Sociodemographic Variables and Pain Sites for CP Participants with and Without IGT Data*

Variable	Group		<i>p</i>
	CP With IGT ( <i>n</i> = 33)	CP Without IGT ( <i>n</i> = 100)	
Age	20.3 (0.4)	20.0 (1.7)	.79
Annual Family Income			.68
0 – 9,999	3.0%	1.1%	
10,000 – 19,000	12.1%	11.0%	
20,000 – 29,000	6.1%	3.3%	
30,000 – 39,000	6.1%	9.9%	
40,000 – 49,000	6.1%	2.2%	
50,000 and Greater	60.6%	58.2%	
Unknown	6.1%	14.3%	
Education (Total Years)	14.4 (1.3)	14.2 (1.3)	.71
Ethnicity			.90
African American	3.0%	5.5%	
American Indian or Alaskan Native	0.0%	1.1%	
Asian or Pacific Islander	15.2%	9.9%	
Caucasian	60.6%	61.5%	
Hispanic	21.2%	20.9%	
Gender (Female)	75.8%	69.2%	.60
Marital Status			.41

Divorced	0.0%	0.0%	
Engaged	3.0%	3.3%	
Living Together	9.1%	11.0%	
Married	3.0%	0.0%	
No Response	0.0%	3.3%	
Single	84.8%	82.4%	
Pain Site			.91
Head, face, mouth	3.0%	2.2%	
Cervical	3.0%	0.0%	
Upper shoulders and limbs	9.1%	13.2%	
Thoracic	3.0%	2.2%	
Abdominal	3.0%	6.6%	
Lower back	33.3%	35.2%	
Lower limbs	27.3%	22%	
Pelvic	9.1%	0.0%	
More than 3 sites	9.1%	7.7%	
Unknown	9.1%	11.0%	

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*Note.* CP: pain lasting three months or longer that is not episodic. Pain site classified using the IASP classification system (IASP, 1994).

Table 6

*Correlations among Sociodemographic and Variables of Interest for Participants*

Variable	2	3	4	5	6	7	8	9	10	11
1. Age	.05	.08	-.16*	.85**	-.13	.17*	.11	.13	-.78**	-.17**
2. Gender	-	.08	-.16*	.08	-.01	.21**	.09	-.02	-.12	-.09
3. Ethnicity		-	-.14	.10	.04	-.01	-.02	-.15*	-.11	.02
4. Annual Income			-	-.10	.01	-.11	-.04	-.02	.09	.08
5. Total Years of Education				-	.08	.07	.03	.12	-.82**	-.11
6. Mood					-	.53**	.61**	.08	-.11	-.54**
7. Somatization						-	.54**	.04	-.07	-.42**
8. Pain							-	.12	-.05	-.46**
9. Subjective Decision-Making								-	-.12	-.08
10. Academic Achievement									-	.12
11. Quality of Life										-

*Note.* \*  $p < .05$ . \*\*  $p < .01$ .

Table 7

*Correlations among Sociodemographic and Variables of Interest for Participants Who Completed all Measures Including the IGT*

Variable	2	3	4	5	6	7	8	9	10	11	12	13
1. Age	-.15	-.08	-.20	.77**	-.13	.02	.14	.12	.04	.10	-.80**	-.19
2. Gender	-	.01	-.12	-.06	.19	.20	.47**	.24*	.04	-.13	.05	-.15
3. Ethnicity		-	-.04	-.02	-.06	.07	.14	-.04	-.14	-.28*	.09	-.05
4. Annual Income			-	-.17	-.10	-.01	-.11	-.04	.03	-.14	.17	.16
5. Total Years of Education				-	-.18	-.04	.03	.09	.04	.10	-.87**	-.04
6. Attention					-	.26*	.22	.16	.01	-.05	.25*	-.08
7. Mood						-	.74**	.61**	-.16	-.01	.02	-.58**
8. Somatization							-	.59*	.06	-.10	.09	-.63**
9. Pain								-	.14	.02	-.12	-.43**
10. Objective Decision-Making									-	-.19	-.12	.01
11. Subjective Decision-Making										-	.10	.26*

12. Academic Achievement

- .07

13. Quality of Life

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*Note.* \*  $p < .05$ . \*\*  $p < .01$ .

Table 8

*Adjusted Means, Univariate Statistics, and Effect Size Estimate for Subjectively Measured Risky Decision-Making*

Variable	Group		<i>F</i>	<i>p</i>	$\eta^2$
	CP ( <i>n</i> = 133)	NP ( <i>n</i> = 133)			
	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )			
<i>Subjective</i> Decision-Making	4.5(1.2)	4.6 (1.2)	0.03	0.87	0.00
Academic Achievement	2.0 (1.1)	1.7 (1.1)	4.5	0.03*	0.03

*Note.* CP: pain lasting three months or longer that is not episodic, NP: no current acute pain, history of chronic pain, or episodic pain. \*  $p < .05$

Table 9

*Adjusted Means, Univariate Statistics, and Effect Size Estimate for the Interactive effect of Pain Status and Mood on Quality of Life*

Variable	Group				<i>F</i>	<i>p</i>	$\eta^2$
	CP ( <i>n</i> = 133)		NP ( <i>n</i> = 133)				
	Low Mood Disturbance (SD)	High Mood Disturbance (SD)	Low Mood Disturbance (SD)	High Mood Disturbance (SD)			
Quality of Life	71.4 (3.0)	50.0 (2.2)	71.4 (2.1)	60.8 (3.1)	4.3	.04*	.02

*Note.* CP: pain lasting three months or longer that is not episodic, NP: no current acute pain, history of chronic pain, or episodic pain. \*  $p < .05$

Table 10

*Adjusted Means, Univariate Statistics, and Effect Size Estimate for Objectively Measured Risky Decision-Making*

Variable	Group		<i>F</i>	<i>p</i>	$\eta^2$
	CP ( <i>n</i> = 33)	NP ( <i>n</i> = 33)			
	<i>M (SD)</i>	<i>M (SD)</i>			
<i>Objective Decision-Making</i>	1821 (1072)	1865 (928)	0.03	0.90	0.00

*Note.* CP: pain lasting three months or longer that is not episodic, NP: no current acute pain, history of chronic pain, or episodic pain. \* *p* < .05

Table 11

*Hierarchical Regression Analysis of Mood, Subjectively Measured Risky Decision-Making, and Pain Predicting Academic Achievement and Quality of Life*

Predictor Variable and Step	Academic Achievement				Quality of Life			
	R <sup>2</sup>	ΔR <sup>2</sup>	β	<i>F Model</i>	R <sup>2</sup>	ΔR <sup>2</sup>	β	<i>F Model</i>
Step 1:	.60			35.3***	.09			2.3
Age			-.76***				-.13	
Gender			-.11				-.14	
Ethnicity			-.04				.12	
Family Income			-.10				-.04	
Step 2:	.60	.00		28.4***	.24	.15		5.8***
Pain			-.04				-.11	
Step 3:	.60	.00		24.0***	.46	.23		
Mood			-.05				-.55***	13.4***
Step 4:	.60	.00		20.0***	.46	.00		11.3***
<i>Subjective Decision-Making</i>			.02				-.02	

Note. \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

Table 12

*Hierarchical Regression Analysis of Pain, Mood, and Objectively Measured Risky Decision-Making Predicting Academic Achievement and Quality of Life*

Predictor Variable and Step	<u>Academic Achievement</u>				<u>Quality of Life</u>			
	R <sup>2</sup>	ΔR <sup>2</sup>	β	<i>F Model</i>	R <sup>2</sup>	ΔR <sup>2</sup>	β	<i>F Model</i>
Step 1: Pain	.00		-.00	.02	.07		-.07	4.6*
Step 2: Mood	.00	.00	.01	.05	.40	.34	-.63***	21.2***
Step 3: <i>Objective</i> Decision-Making	.02	.02	-.15	.49	.42	.04	-.14	15.0***

*Note.* \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

Table 13

*Means, Univariate Statistics, and Effect Size Estimate for Subjective Decision-Making by MPI Coping Group*

Variable	Group			<i>F</i>	<i>p</i>	$\eta^2$
	AC ( <i>n</i> = 19)	ID ( <i>n</i> = 10)	DYS ( <i>n</i> = 19)			
	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )			
<i>Subjective Decision-Making</i>	4.5 (0.8)	4.1 (1.0) <sub>A</sub>	5.0 (1.1) <sub>B</sub>	3.6	0.04*	0.13

*Note.* NP: no current acute pain, history of chronic pain, or episodic pain, AC: Adaptive Coper, ID: Interpersonally Distressed Coper, DYS: Dysfunctional Coper. Means with different letters are significantly different. \*  $p < .05$

Table 14

*Means, Univariate Statistics, and Effect Size Estimate for MPI Scale by Pain Status*

Variable	Group		<i>F</i>	<i>p</i>	$\eta^2$
	CP ( <i>n</i> = 133)	NP ( <i>n</i> = 133)			
	<i>M (SD)</i>	<i>M (SD)</i>			
LC	3.2 (1.2)	3.3 (1.4)	1.0	0.3	0.0
AD	3.0 (1.2)	2.3 (1.1)	21.1	<.001***	0.1
S	2.6 (2.0)	1.1 (1.5)	36.0	<.001***	0.2
GAL	2.7 (0.8)	2.7 (0.8)	0.0	0.9	0.0

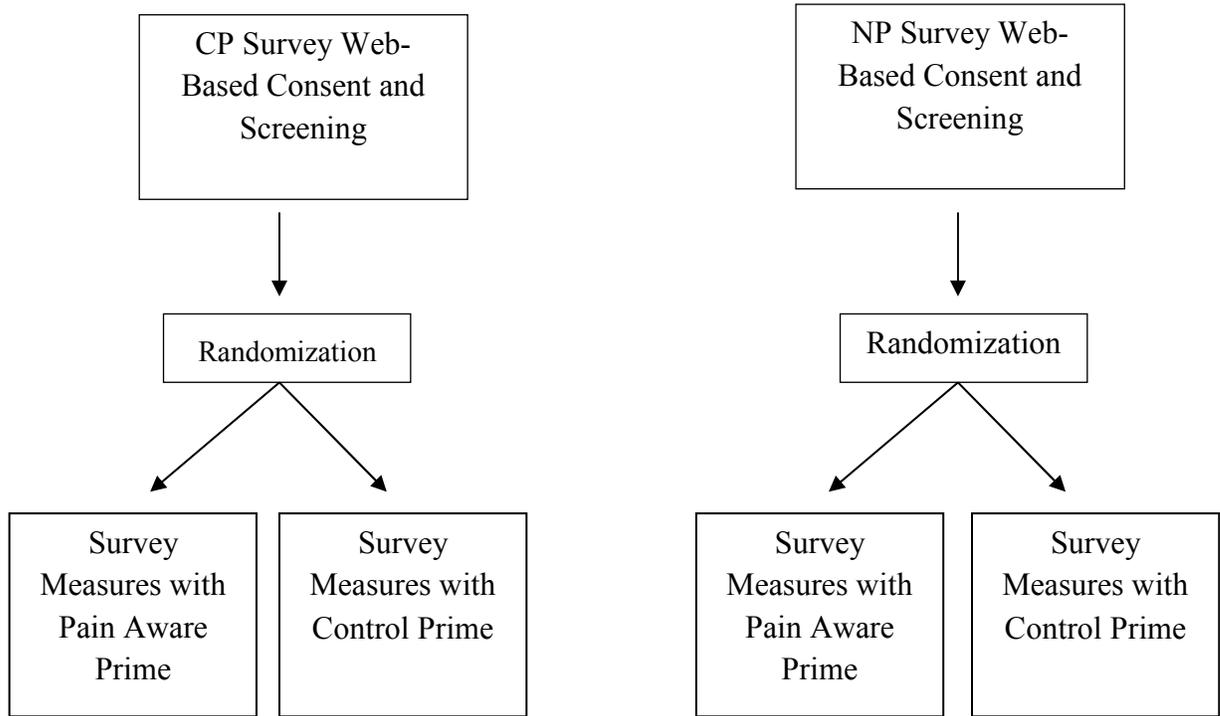
*Note.* LC: Life Control, AD: Affective Distress, S: Support, GAL: General Activity Level, NP: no current acute pain, history of chronic pain, or episodic pain, \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

Table 15

*Means, Univariate Statistics, and Effect Size Estimates for MPI Scale by NP and MPI Coping Group*

Variable	Group				<i>F</i>	<i>p</i>	$\eta^2$
	AC ( <i>n</i> = 19)	ID ( <i>n</i> = 19)	DYS ( <i>n</i> = 15)	NP ( <i>n</i> = 19)			
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>			
LC	3.8 (1.1) <sub>A</sub>	3.2 (1.2)	2.4 (0.7) <sub>B</sub>	3.5 (1.2)	4.1	.01**	0.2
AD	1.8 (1.1) <sub>A</sub>	3.4 (0.8) <sub>B</sub>	4.2 (0.9) <sub>B</sub>	2.2 (0.9) <sub>A</sub>	22.3	<.001** *	0.5
S	2.2 (1.1) <sub>B</sub>	4.9 (1.0) <sub>A</sub>	2.8 (1.3) <sub>B</sub>	1.6 (1.7) <sub>B</sub>	24.0	<.001** *	0.5
GAL	2.6 (0.7)	2.7 (0.8)	2.5 (0.5)	2.7 (1.0)	0.4	0.8	0.0

*Note.* LC: Life Control, AD: Affective Distress, S: Support, GAL: General Activity Level, NP: no current acute pain, history of chronic pain, or episodic pain, AC: Adaptive Coper, ID: Interpersonally Distressed Coper, DYS: Dysfunctional Coper. Means with different letters are significantly different. \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$



*Figure 1.* Participant Flow. CP: pain lasting three months or longer that is not episodic, NP: no current acute pain, history of chronic pain, or episodic pain.

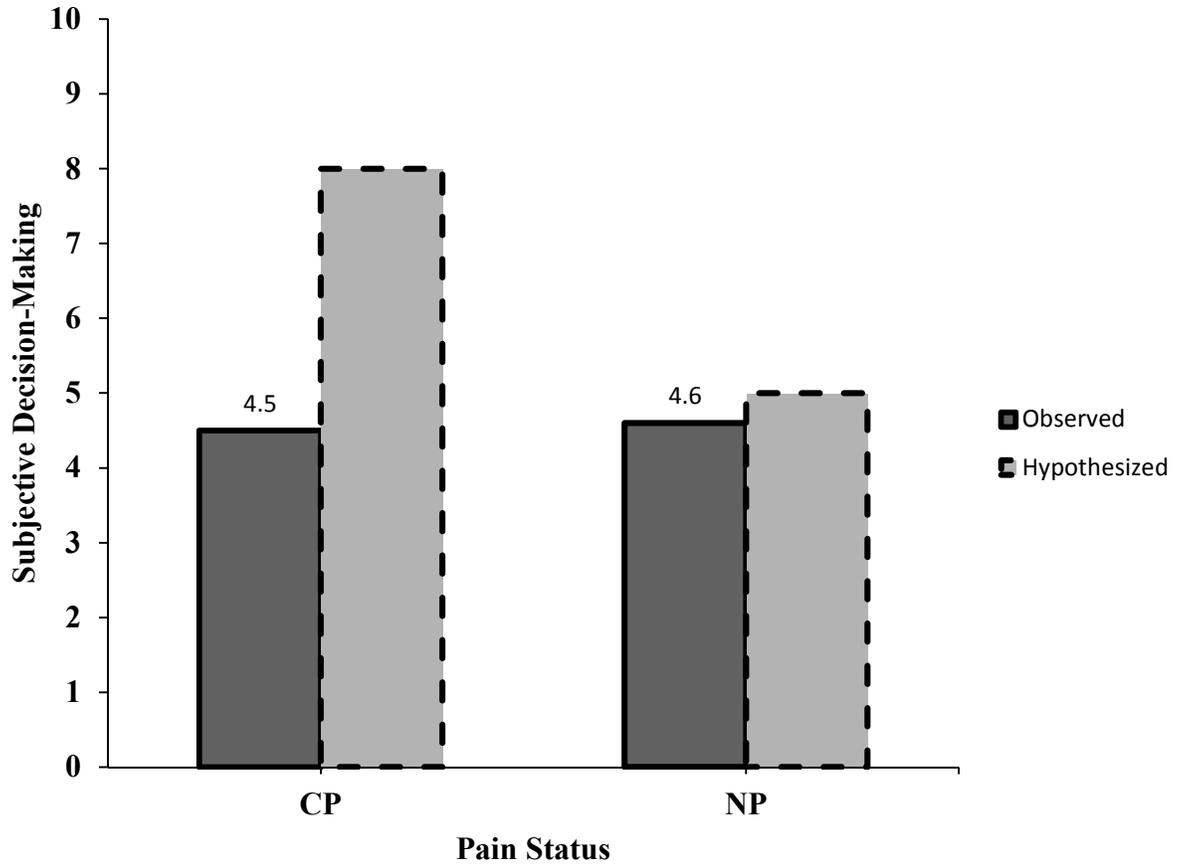
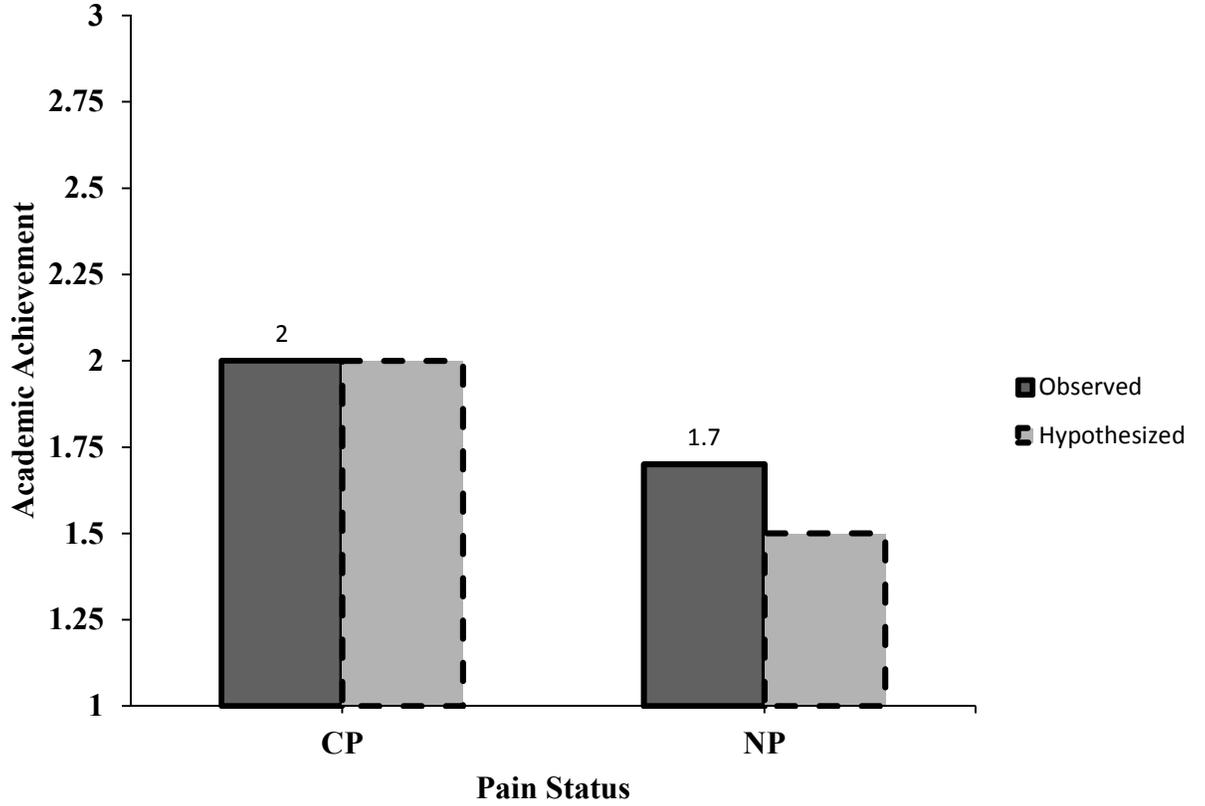
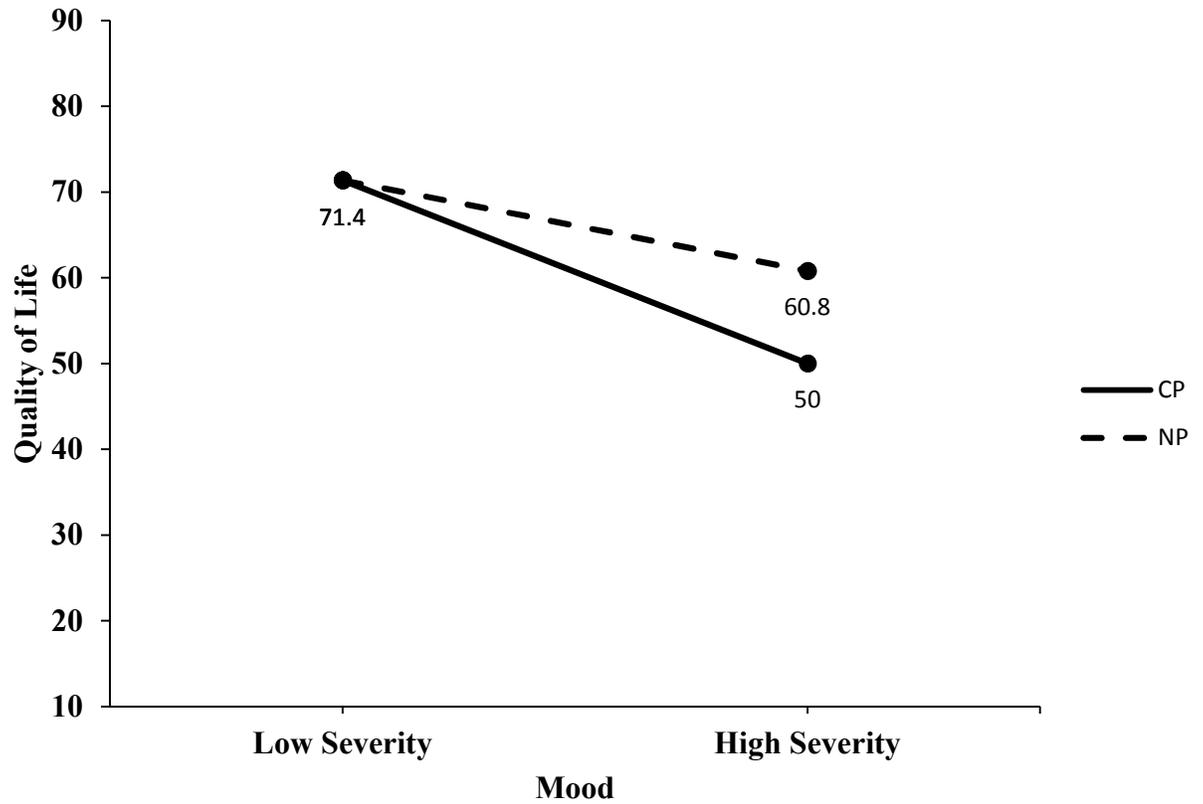


Figure 2. **Hypothesized** and **observed** relation of pain status to decision-making as *subjectively* measured, where lower scores are equal to riskier decision-making. CP: pain lasting three months or longer that is not episodic, NP: no current acute pain, history of chronic pain, or episodic pain.



*Figure 3. Hypothesized and observed relation of pain status to academic achievement. Academic achievement scaled so that lower scores indicate better grade point average. CP: pain lasting three months or longer that is not episodic, NP: no current acute pain, history of chronic pain, or episodic pain.*



*Figure 4.* Interactive effect of pain status and mood on quality of life. Higher score is equal to greater reported quality of life. CP: pain lasting three months or longer that is not episodic, NP: no current acute pain, history of chronic pain, or episodic pain.

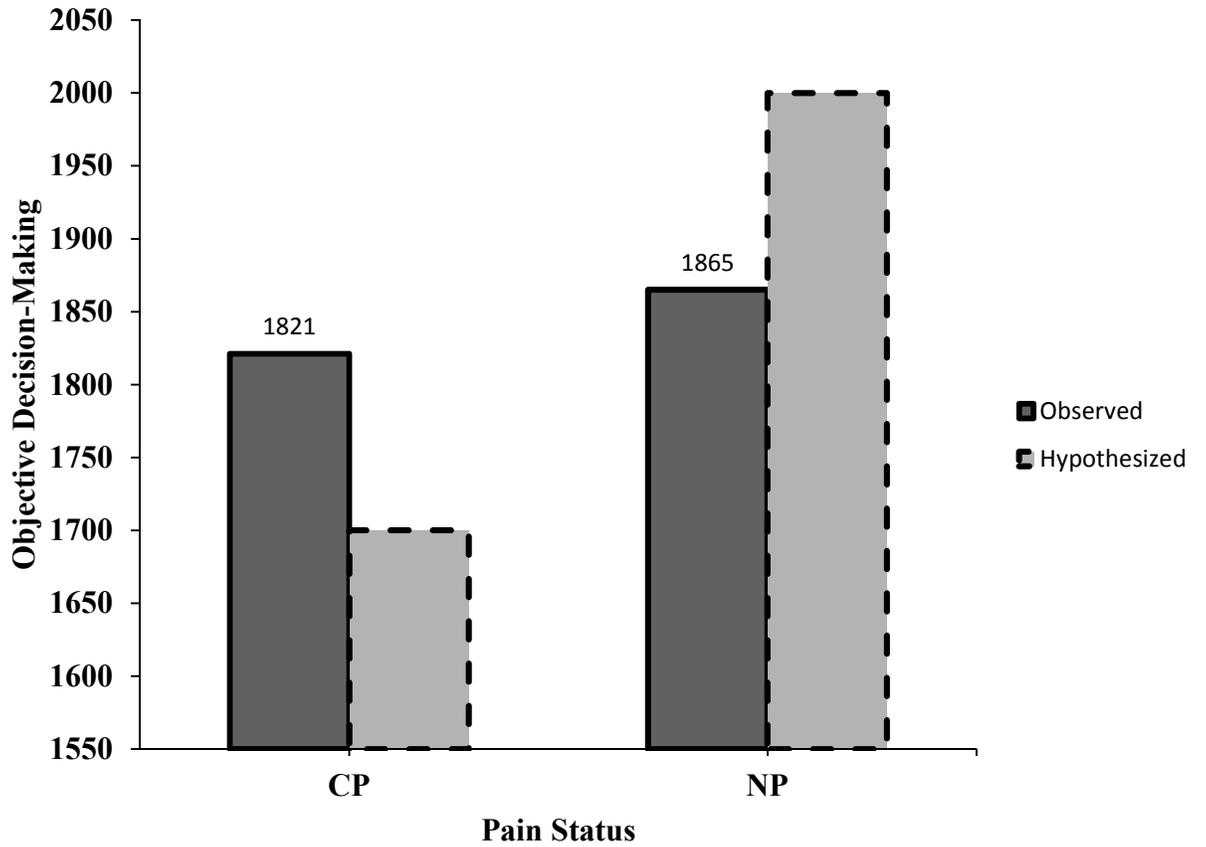


Figure 5. **Hypothesized** and **observed** relation of pain status to decision-making as *objectively* measured, where higher scores are equal to riskier decision-making. CP: pain lasting three months or longer that is not episodic, NP: no current acute pain, history of chronic pain, or episodic pain.