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Negative Health Consequences of Pain Catastrophizing among Retired National Football League Athletes

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Abstract

Objective: This study examined the association between pain catastrophizing with pain interference, depressive symptoms, and health related quality of life (HRQoL) among National Football League (NFL) retirees.

Method: Former NFL athletes from the Retired NFL Players Association (N=90) were recruited from 2018–2019 via telephone and administered measures of pain, substance use, depressive symptoms, and HRQoL. Multiple linear and binomial regression analyses examined the association of pain catastrophizing with pain interference, depressive symptoms, and HRQoL while controlling for covariates (i.e., pain intensity, concussions, opioid use, binge alcohol use, years since NFL retirement, and marital status).

Results: Many retired NFL athletes reported moderate-severe depressive symptoms as well as poorer perceived physical health compared to general medical patients. Greater pain catastrophizing was associated with more severe pain interference, greater odds of reporting moderate-severe depressive symptoms, and lower odds of reporting average and above physical and mental HRQoL after adjusting for relevant covariates Concussions were not associated with any of the study outcomes.

Conclusions: Given the findings from this study, healthcare professionals should monitor symptoms of catastrophizing among current and retired NFL athletes. Assessment and requisite treatment of pain catastrophizing may assist these elite athletes in reducing depressive symptoms, while improving pain interference and HRQoL in this population.

Keywords

National Football League; Pain; Pain Catastrophizing; Depression; Quality of Life

Introduction

Despite previous findings suggesting significant relationships between pain catastrophizing and adverse health outcomes among various clinical populations, studies have not yet examined the association between pain catastrophizing and pain interference, depressive symptoms, and health related quality of life (HRQoL) among retired National Football League (NFL) athletes. Research suggests that retired NFL athletes experience greater risk of pain than general medical patients due to frequent muscle overuse, accumulated musculoskeletal injuries, and repetitive head trauma during their football careers (Golightly, Marshall, Callahan, & Guskewicz, 2009; Schwenk et al., 2007; Weir, Jackson, & Sonnega, 2009). Over 90% of NFL retirees report experiencing current pain, with 70% of them perceiving their pain to be moderate to severe—rates 3x greater than those observed among the general population (Cottler et al., 2011; Schwenk et al., 2007). More specifically, nearly 50% of NFL retirees report symptoms of migraines and daily low back pain, while up to 90% experience daily pain in at least one joint (Weir, Jackson, & Sonnega, 2009).

The psychological burden among subgroups of retired NFL athletes is high (Mannes et al., 2019). While recent research suggests that the prevalence of depression among NFL retirees ranges from 4.0–30.0%, depressive symptoms are more prevalent among former athletes who report more severe pain and higher rates of concussion (Kerr, Marshall, Harding, & Guskewicz, 2012; Schwenk, Gorenflo, Dopp, & Hipple, 2007). Further, concussions, pain, poorer perceived physical functioning, and longer duration of retirement from the NFL have been associated with significant depressive symptoms and lower HRQoL among NFL retirees, while substance use, such as opioid and binge alcohol use, is a robust correlate of depressive symptoms and lower QoL among general medical patients (Karafin et al., 2018; Kerr et al., 2012; Nicholas, Nicholas, & Nicholas, 2007; Okoro, et al., 2004; Paljärvi et al., 2009; Scherrer et al., 2016; Salas et al., 2018; Schwenk et al., 2007). Although these relationships are well studied among various clinical populations, retired NFL players are situated within a unique context after transitioning from professional football, in which they are at greater risk of experiencing pain, negative mental and physical health symptoms associated with pain, and lack of mental health care utilization in retirement (Mannes et al., 2019). Therefore, greater understanding of modifiable, psychosocial predictors of the health consequences among NFL retirees is warranted in order to facilitate improved multidisciplinary treatment.

Cognitive-behavioral theories have been utilized extensively to understand the physical and psychology sequelae of chronic pain. These theories postulate that maladaptive behaviors and cognitive schemas contribute to negative health outcomes among adults living with pain (Ehde, Dillworth, & Turner, 2014). For example, pain catastrophizing is a common, cognitive pattern that accompanies pain, and is one of the most important psychological and treatable factors contributing to pain perception (Schütze et al., 2018; Sullivan et al., 2001).

Individuals with greater pain catastrophizing experience magnified worry, engage in maladaptive cognitions associated with pain (e.g., “there is nothing I can do to reduce my pain”), and overestimate the likelihood of unpleasant pain-related outcomes (e.g., “the pain is never going to get better”). Among general medical patients, pain catastrophizing is associated with poorer pain related coping and avoidance of activities that an individual believes may exacerbate their pain, which can lead to more frequent rumination, increased pain sensitivity, and greater disability (Leung, 2012; Quartana, Campbell, & Edwards, 2009; Severeijns, Vlaeyen, & van den Hout, 2004). Moreover, among patients with low back pain and osteoarthritis, conditions prevalent among retired NFL athletes, pain catastrophizing is associated with development of chronic pain and poor treatment outcomes (Farin, 2015; Linton & Shaw, 2011; Leeuw et al., 2007; Nichols et al., 2011). Thus, retired NFL players may be particularly susceptible to pain catastrophizing and associated adverse consequences given the high rates of pain and painful medical conditions among this population. Consequently, pain catastrophizing may be associated with greater pain interference (i.e., the extent to which pain interferes with daily life), significant depressive symptoms, and poorer perceived HRQoL among NFL retirees.

Despite the high prevalence of pain among NFL retirees, previous studies have yet to extend prior findings regarding the health effects of pain catastrophizing among general medical populations to former NFL athletes. Additionally, these studies have predominantly relied on measurements of pain intensity and diagnoses of painful medical conditions (Cottler et al., 2011; Nicholas, Nicholas, & Nicholas, 2007; Schwenk et al., 2007). Thus, this study aimed to (1) assess clinical and sociodemographic differences in pain catastrophizing among NFL retirees, and (2) examine the association between pain catastrophizing and four relevant health outcomes among former NFL athletes: pain interference, depressive symptoms, and HRQoL (mental and physical). Similar to other populations, authors hypothesized that retirees reporting more severe pain intensity, interference, recent substance use (i.e., opioids, marijuana, or alcohol binging), current depressive symptoms, and lower HRQoL would report significantly greater pain catastrophizing. It was further hypothesized that pain catastrophizing would be associated with more severe pain interference, greater odds of reporting moderate-severe depressive symptoms, and lower odds of reporting average or above HRQoL among NFL retirees after controlling for covariates.

Method

Participants & Procedures

The sample (N=90) consisted of former NFL athletes who played professional American football between 1967–2004. NFL retirees were recruited between 2018–2019 via telephone from a databank comprised of Retired NFL Players Association members who participated in Cottler and colleagues (2011) retrospective cohort study. All 644 retired NFL athletes who took part in the initial study were eligible for participation. Trained research assistants attempted contact with all NFL retirees.

Research assistants called each NFL retiree at least twice on a provided home or mobile telephone number. A brief voicemail message was left with former NFL athletes who did not answer the telephone and had an available voice mailbox. If an NFL retiree was reached, a

University of Florida Institutional Review Board (IRB) approved standardized script was delivered that reminded each retired athlete of their participation in the Cottler et al., 2011 study, as well as provided information pertaining to the content, rationale, and duration (15–30 minutes) of the current study. Given that recruitment was conducted over the phone, the University of Florida IRB granted a waiver of informed consent, such that verbal consent was sufficient to enroll study participants. Following informed verbal consent, research assistants administered the study measures that assessed NFL career information, substance use, pain factors, current depressive symptoms, and HRQoL. All responses were recorded via computer on Research Electronic Data Capture (REDCap) software (Harris et al., 2009). Following the interview, participant information was immediately de-identified and replaced with the corresponding identification number that was created during initial data collection in 2010–2011 (Cottler et al., 2011). NFL retirees were not monetarily compensated for their participation. The University of Florida IRB approved this study.

Measures

Pain Catastrophizing: The Pain Catastrophizing Scale (PCS) assessed the severity of pain-associated rumination, magnification, and helplessness. The PCS is comprised of 13 Likert type items, ranging from not at all (0) to all the time (4), yielding a total score ranging from 0–52. The PCS has demonstrated excellent internal consistency, discriminant validity, and reliability (Osman et al., 2000; Sullivan, Bishop, & Piviki, 1995). Pain catastrophizing was examined as a continuous variable with higher scores indicating more severe symptoms.

Pain Interference: The Brief Pain Inventory Short Form (BPI-SF) Pain Interference Scale (PIS) measured the extent to which pain interfered with participants' daily functioning over the past 24-hours. The PIS utilizes seven questions, with responses ranging from 0 (does not interfere) to 10 (completely interferes) within the areas of walking, mood, work, sleep, social relationships, general activity, and overall life satisfaction. The PIS is one of the most commonly used measures for assessing pain interference and has demonstrated strong psychometrics across patient populations (Keller et al., 2004). Scores on interference items were summed and divided by seven to create a score of "average" pain interference (Cleeland, 2009).

Depressive Symptoms: Depressive symptoms over the past 7 days were assessed using the Center for Epidemiologic Studies Depression Scale (CES-D). Possible responses to 20 Likert scale questions range from "0" (rarely or none) to "3" (most, or all the time) with higher scores indicating greater depressive distress (Radloff, 1977). The psychometrics of the CES-D have been consistently validated, particularly among patients living with pain and painful medical conditions (Cosco et al., 2017; Milette et al., 2010). Participants were dichotomized into none/mild depressive symptoms (0–15) and moderate-severe symptoms (16). This cut-off is in line with original scoring guidelines and has exhibited strong sensitivity (87%) and adequate specificity (70%; Radloff, 1977; Vilagut et al., 2016).

HRQoL: The Medical Outcomes Study Short Form 12-Item (SF-12) measured HRQoL within eight domains (e.g., general health, physical functioning, role physical, bodily pain, vitality, social functioning, role emotional, and mental health). Coinciding with the SF-12

scoring guidelines, a composite physical and mental HRQoL score was calculated from the subdomains and transformed to a T-score distribution with a mean of 50 and a SD of 10 (Jenkinson et al., 1997). NFL retirees were dichotomized into two groups based on their total HRQoL scores for each domain: low (<40) to indicate retirees who scored lower than 1 SD below the mean and average or above (≥ 40). The SF-12 demonstrates strong psychometrics in a multitude of patient populations, including those with pain and depression (Hayes et al., 2017; Huo et al., 2018; Luo et al., 2003).

Covariates

Pain Intensity: Pain intensity was measured using a numeric rating scale (0–10= “pain as bad as you can imagine”) of current pain, which has demonstrated good validity and reliability (Hjermstad et al., 2011; Ferreira-Valente, Pais-Ribeiro, & Jensen, 2011). Greater pain intensity is associated with more severe pain related interference, depressive symptoms, and lower HRQoL (Börsbo, Peolsson, & Gerdle, 2009; Mok & Lee, 2008; Yazdi-Ravandi et al., 2013).

Opioid Use: Retirees who reported using prescribed or non-prescribed opioids in the past 12-months were categorized as opioid users. Opioid use has been linked to incidence of clinical depression, and lower HRQoL among adults living with pain (Karafin et al., 2018; Salas et al., 2018; Scherrer et al., 2016).

Binge Alcohol Use: Binge alcohol consumption was determined based on participant report of consuming 5 or more alcoholic drinks on at least one occasion during the past 30 days and retirees were dichotomized based on this endorsement (National Institute on Alcohol Abuse and Alcoholism, 2004). Binge alcohol use is associated with depression and lower HRQoL among general medical patients (Okoro, et al., 2004; Paljärvi et al., 2009).

Lifetime Concussion History: Concussions were defined as “occurring typically but not necessarily from a blow to the head, followed by a variety of symptoms that may include any of the following: headache, dizziness, loss of balance, blurred vision, ‘seeing stars,’ feeling in a fog or slowed down, memory problems, poor concentration, nausea, throwing up, and loss of consciousness” (Kerr et al., 2018; McCrea et al., 2004). Retired athletes recalled the number of diagnosed and undiagnosed concussions they experienced during their lifetime. A continuous, composite concussion variable was created by summing the number of reported diagnosed and undiagnosed concussions. Previous research has demonstrated a positive association between concussions and depressive symptoms among NFL retirees, as well lower mental and physical HRQoL among former collegiate football athletes (Didehban et al., 2013; Guskiewicz et al., 2007; Kerr et al., 2012; Kerr et al., 2018).

Sociodemographics: NFL Career Information, and Additional Pain Information: A number of variables were considered based on previous literature, including age (39–49, 50–59, 60–69, 70+), marital status (married vs non-married), education (high school, college, graduate school/other), current employment (no, yes, retired), race/ethnicity (Nonwhite, White), years since NFL retirement (0–19, 20–29, 30–39, 40–49), NFL games played (1–49, 50–99, 100–149, 150+), NFL position (offense lineman [OL] /defensive lineman [DL],

quarterback [QB], running back [RB]/linebacker [LB], wide receiver [WR] /defensive back [DB], fullback [FB]/tight end [TE]), and number of years living with pain (0–9, 10–19, 20–29, 30–39, 40+). Retirees also reported the somatic sites (i.e., shoulder(s), knees(s), back, neck, and phalanges [i.e., fingers & toes]) where they currently experienced pain.

Statistical Analyses

All analyses were performed in IBM SPSS Version 25 (SPSS, Version 25; IBM, Armonk, NY). Univariate descriptive statistics were calculated for sample sociodemographics, substance use, pain factors, depressive symptoms, and HRQoL. Pearson correlations, independent sample t-tests, and one-way ANOVAs were utilized to assess bivariate associations between study variables and pain catastrophizing. Multiple linear regression assessed the relationship between pain catastrophizing, potential covariates, and pain interference. The association between pain catastrophizing with moderate-severe depressive symptoms and HRQoL was assessed via adjusted binomial regression analyses with non-mild depressive symptoms and low HRQoL serving as the designated referent groups respectively. All analyses controlled for confounding variables (i.e., opioid use, pain intensity, and marital status) that were significantly associated with pain catastrophizing in bivariate analysis ($p < 0.05$), as well as total concussions, years since NFL retirement, and binge alcohol use, factors associated with study outcomes supported by the literature. Adjusted odds ratios with 95% confidence limits were presented. Multicollinearity between independent variables was assessed by variance inflation factor (VIF). VIF values >10 are indicative of possible multicollinearity (Hair, Black, Babin, Anderson, & Tatham, 2006). No multicollinearity was observed in multivariate analyses as all VIF values ranged between 1 and 2.

Results

Recruitment Rate

Of the original 644 retired NFL athletes, 17 were identified as deceased and 294 had a disconnected or inaccurate telephone number, reducing the eligible sample to 333 retired athletes. Research assistants made contact with 132 retirees from the eligible pool. Of the 132 reached, 18 declined, 24 deferred and did not complete study measures, and 90 participated and completed all study measures. The adjusted response rate was 27.02%, while the cooperation rate, which assesses the rate of participation among NFL retirees with verified contact, was 68.18%. All eligible participants who initiated the interview completed the questionnaire battery, resulting in no missing data.

Sociodemographics, NFL Career, and Health

The sample ($N = 90$) had a mean age of 57.68 years ($SD = 9.94$) and the majority (64.44%) of the sample identified as White. Most (77.11%) graduated from college, 73.33% were currently employed, and 77.78% were married. Retirees were representative of all NFL positions other than special teams (i.e., kickers & punters). The most common (31.11%) position reported by retirees was OL/DL. Retirees reported 90.53 ($SD = 55.45$) NFL games played, and 28.83 ($SD = 8.68$) years since NFL career retirement.

In regard to health information, 26.67% of retirees reported past 30-day binge alcohol use, while 15.56% and 23.33% reported past 12-month marijuana and opioid use respectively. Retired athletes sustained an average of 30.41 ($SD=49.11$) concussions during their lifetimes and noted living with pain for 20.65 ($SD=13.92$) years. NFL retirees reported an average pain catastrophizing score of 11.72 ($SD=13.06$), as well as scores of 2.18 ($SD=2.39$) and 2.54 ($SD=2.51$) on measures of pain intensity and interference respectively. The average score on the CES-D was 11.89 ($SD=12.18$), and 30.00% of NFL retirees reported experiencing moderate-severe depressive symptoms (16). Participants reported mean physical and mental HRQoL of 42.73 ($SD=11.08$) and 51.22 ($SD=11.74$). Nearly 37.78% and 20.00% of NFL retirees reported a physical and mental HRQoL score below 40.0 respectively.

Pearson correlations demonstrated significant bivariate associations between pain catastrophizing with pain intensity ($r(90) = .60, p<0.001$) and pain interference ($r(90) = .68, p<0.001$). Pain catastrophizing, ($r(90) = .51, p<0.001$), pain intensity, ($r(90) = .43, p<0.001$), and pain interference ($r(90) = .58, p<0.001$) were associated with depressive symptoms (not shown in tables).

Independent-samples t-tests identified significantly greater catastrophizing among NFL retirees who were unmarried, $t(88)=-2.23, p<0.001$, and used opioids $t(88)=-2.72, p=0.007$. In regard to pain location, retirees reporting current shoulder, $t(88)=-2.70, p=0.008$, hip, $t(88)=-2.01, p=0.047$, and head pain, $t(88)=-2.22, p=0.029$, experienced more severe catastrophizing compared to those without pain in those locations. Participants reporting moderate-severe depressive symptoms, $t(88)=-5.57, p<0.001$, as well as poorer perceived physical, $t(88)=5.70, p<0.001$, and mental $t(88)=4.60, p<0.001$, HRQoL also reported significantly greater pain catastrophizing scores. Please refer to Tables 1 and 2 for more information pertaining to sample characteristics and group differences in pain catastrophizing.

Association between Pain Catastrophizing and Pain Interference—All

multivariate analyses adjusted for pain intensity, opioid use, binge alcohol use, concussions, years since NFL retirement, and marital status. Linear regression analysis assessed the association between pain catastrophizing and pain interference. Pain catastrophizing ($\beta = .68, p<0.001$) was associated with pain interference prior to covariate adjustment. The multiple regression model including pain catastrophizing and covariates was significant, ($F(7, 81) = 27.75, p<0.001$, and accounted for 70.6% of the variance in pain interference. Pain catastrophizing remained significantly associated with pain interference ($\beta = .32, p<0.001$) after accounting for covariates (Table 3).

Association between Pain Catastrophizing and Moderate-Severe Depressive Symptoms—

Binomial regression analysis assessed the association between pain catastrophizing and moderate-severe depressive symptoms. Pain catastrophizing was associated with moderate-severe depressive symptoms in unadjusted analysis ($OR: 1.10, 95\% CI: 1.05-1.15, p<0.001$). After accounting for covariates, the overall model was significant, $\chi^2(9) = 34.76, p<0.001$, and explained 46.10% of the variance in moderate-severe depressive symptoms. Pain catastrophizing ($AOR: 1.09, 95\% CI: 1.02-1.15, p=0.006$)

was the only variable associated with moderate-severe depressive symptoms in the adjusted model (Table 4).

To confirm that findings were not an artifact of dichotomization, a posthoc multiple linear regression assessed the association between pain catastrophizing, covariates, and a continuous measure of depressive symptoms. The multiple regression model including pain catastrophizing and covariates was significant, ($F(7, 81) = 15.47, p < 0.001$), and accounted for 57.2% of the variance in depressive symptoms. After covariate adjustment, pain catastrophizing ($\beta = .44, p < 0.001$) and pain intensity ($\beta = .37, p < 0.001$) were significantly associated with depressive symptoms.

Association between Pain Catastrophizing with Physical and Mental HRQoL—

Binomial regression analysis assessed the association between pain catastrophizing with average or above (≥ 40) physical and mental HRQoL. Pain catastrophizing was negatively associated with average and above physical HRQoL ($OR: 0.90, 95\% CI: 0.60-0.95, p < 0.001$). The overall model including pain catastrophizing and covariates was significant, $\chi^2(9) = 52.66, p < 0.001$, accounting for 60.7% of variance in physical HRQoL. Pain catastrophizing remained significantly associated with physical HRQoL ($AOR: 0.88, 95\% CI: 0.81-0.96, p = 0.003$) after covariate adjustment. Similarly, pain catastrophizing was also negatively associated with average or above mental HRQoL ($OR: 0.93, 95\% CI: 0.89-0.97, p < 0.001$). The overall model was significant, $\chi^2(9) = 26.26, p = 0.002$, accounting for 41.0% of the variance in mental HRQoL. Pain catastrophizing remained associated with mental HRQoL ($AOR: 0.93, 95\% CI: 0.88-0.99, p = 0.029$) after adjusting for covariates (Table 5).

Posthoc multiple linear regressions also assessed the association between pain catastrophizing, covariates, and a continuous measure of physical and mental HRQoL. The physical HRQoL multiple regression model including pain catastrophizing and covariates was significant, ($F(7, 81) = 8.25, p < 0.001$), and accounted for 41.6% of the variance in the outcome. After covariate adjustment, opioid use ($\beta = -0.30, p = 0.002$), years since NFL retirement (10 year-change; $\beta = -0.20, p = 0.024$), and pain intensity ($\beta = -0.29, p = 0.010$) predicted physical HRQoL while pain catastrophizing trended towards significance ($\beta = -0.19, p = 0.081$).

In regard to a continuous measure of mental HRQoL, the multiple regression model including pain catastrophizing and covariates was significant, ($F(7, 81) = 10.88, p < 0.001$), and accounted for 48.5% of the variance in the outcome. Pain catastrophizing ($\beta = -0.28, p = 0.007$) and pain intensity ($\beta = -0.44, p < 0.001$) were associated with mental HRQoL in multivariate analysis.

Discussion

The purpose of this study was to examine the effect of pain catastrophizing on pain interference, depressive symptoms, and HRQoL among a sample of 90 retired NFL athletes. To the author's knowledge, this is the first study among NFL retirees to conceptualize pain from a cognitive-behavioral perspective through examining the negative health consequences

of pain catastrophizing, a cognitive factor that is amenable to psychological intervention. Findings from this study supported our hypotheses that NFL retirees reporting more severe catastrophizing would also report greater pain intensity, pain interference, opioid use, depressive symptoms, and lower HRQoL, while pain catastrophizing was also associated with more severe pain interference, greater odds of reporting moderate-severe depressive symptoms, and lower odds of reporting average or above HRQoL after accounting for covariates. These relationships remained largely consistent in posthoc analyses, though the association between pain catastrophizing and a continuous measure of physical HRQoL became non-significant.

Pain catastrophizing and pain intensity were significantly associated with greater interference, which is consistent with previous literature (Craner, Sperry, & Evans, 2016; Hirsh, Bockow, & Jensen, 2011). Pain catastrophizing can lead to anxious avoidance of activities that an individual believes may exacerbate their pain, including values-based activities once enjoyed (Leeuw et al., 2007). Stress and catastrophic thinking can also adversely affect sleep quality, as pre-sleep worries associated with pain have been linked to nighttime sleep disturbance, which may lead to daytime fatigue and activity interference (McGowan, Behar, & Luhmann, 2016; Smith et al., 2001). Moreover, pain coping, or cognitive-behavioral strategies to reduce the impact of pain and distress, has been postulated to influence an individual's adjustment to pain and the extent to which pain impedes daily activities (Sullivan et al., 2001). Specifically, passive coping (e.g., resting, laying down, avoidance, medication, and catastrophizing) has a particularly salient, negative effect on pain interference (Tan, Teo, Anderson, & Jensen, 2011). Conversely, problem-focused coping has shown to be particularly effective for pain management, and is used primarily when a person believes that they have some degree of control over their pain (Gatchel, Peng, Peters, Fuchs, & Turk, 2007). A prominent feature of problem-focused behavioral interventions for pain involve optimizing active, or adaptive coping techniques, which can include strategies such as exercise/stretching, activity pacing, approaches to enhance optimism (i.e., positive self-talk, cognitive restructuring) and relaxation (e.g., mindfulness techniques, diaphragmatic breathing, and progressive muscle relaxation; Roditi & Robinson, 2011). For NFL retirees experiencing a greater degree of pain catastrophizing, it may be especially difficult to effectively utilize adaptive pain management strategies (Sullivan et al., 2001).

Thirty percent of retired NFL athletes reported moderate-severe depressive symptoms which is towards the higher end of previously reported rates. There is a robust literature hypothesizing the mechanisms by which catastrophizing impacts depressive symptoms. Catastrophizing is associated with diminished social support, suicidal ideation, and feelings of hopelessness and helplessness, which can contribute to depressed mood (Edwards et al., 2006; Lackner & Gurtman, 2004; Quartana, Campbell, & Edwards, 2009). Moreover, catastrophizing is also linked to suboptimal medication adherence and pharmacotherapy discontinuation, which may exacerbate chronic medical conditions and compound co-occurring mood symptoms (Nicholas et al., 2012; Toth, Brady, & Hatfield, 2014). Furthermore, among patients with obesity and osteoarthritis, two conditions that have become a growing concern among retired NFL athletes, catastrophizing is correlated with poorer weight management, increased disability, and poorer weight related quality of life, all factors that can contribute to mood difficulties (Churchill et al., 2018; Somers et al., 2009).

Many epidemiological studies have examined factors associated with depression among NFL retirees, with most identifying greater number of self-reported concussions as a risk factor for both significant depressive symptoms and clinical depression (Mannes et al., 2019). Notably, concussions were not associated with moderate-severe depressive symptoms in this sample. Despite previous literature elucidating a relationship between self-reported concussion history and depression, several studies have demonstrated a nonsignificant effect of concussions on mood symptoms among contact sport athletes, suggesting that previously unexamined factors may be related to mood symptoms (Casson et al., 2014; Esopenko et al., 2017; Kerr, DeFreese, & Marshall 2014). This study supported this hypothesis, as catastrophizing was the most robust factor associated with moderate-severe depressive symptoms. Taken together, these findings in conjunction with results from this study, suggest that pain and the psychological manifestations that comprise it are particularly salient in explaining depressive symptoms among retired NFL athletes and necessitate further examination.

NFL retirees reporting greater pain catastrophizing in this sample also reported significantly lower physical and mental HRQoL, which is consistent with findings among general medical patients (Craner, Sperry, & Evans, 2016; Semeru et al., 2019; Yakobov et al., 2018). Specifically, pain catastrophizing may interfere with HRQoL through increased pain intensity, exacerbated disability, substance misuse, depression, and anxiety (Leung, 2012; Quartana, Campbell, & Edwards, 2009). Pain catastrophizing can also lead to decreased physical activity due to fear that participation may exacerbate pain (Bousema et al., 2007; Verbunt et al., 2008). Exercise is a particular challenge among retired NFL athletes reporting more severe pain and depressive symptoms, as this subpopulation is more likely to report non-participation in fitness and exercise compared to their low pain and non-depressed counterparts (Schwenk et al., 2007). Given that physical activity can improve pain severity, physical and psychological functioning, treatment adherence, and quality of life among adults living with pain, intervening on pain catastrophizing may be one avenue by which healthcare professionals can reduce depressive symptoms and promote exercise among retired NFL athletes (Geneen et al., 2017). Notably, continued physical activity engagement in retirement may be protective against experiencing symptoms of anxiety and depression among former elite athletes (Bäckmand et al., 2003; 2009).

Following the recommendation by the Centers for Disease Control and Prevention (CDC) to reduce the frequency and quantity of physician-prescribed opioids for individuals with pain-related conditions, cognitive-behavioral interventions have become a top-line treatment for individuals with chronic pain and comorbid conditions, such as mood and substance use disorders (CDC, 2016). Psychological treatments for chronic pain include interventions that seek to modify maladaptive behavioral and cognitive patterns that contribute to pain-associated anxiety, depression, intensity, and interference (Roditi & Robinson, 2011). Given the findings from this study, athletic trainers, psychologists, and physicians should monitor symptoms of catastrophizing, especially among current and retired athletes experiencing shoulder, hip, and head pain. For athletes that necessitate further cognitive behavioral treatment to manage catastrophic thoughts, clinical trials have demonstrated that reducing pain catastrophizing is an important treatment target among individuals with pain, as it has

been shown to be effective for improving depression, functional ability, and HRQoL (Schütze et al., 2018).

This study has several notable strengths and a few noteworthy limitations. First, as this was a cross-sectional study, temporality of the associations between pain catastrophizing and the measured outcomes was unable to be established. Additionally, approximately 300 of the telephone numbers used in the 2011 Cottler study were non-working, which may have inadvertently introduced a selection bias among study participants. However, the cooperation rate for this investigation was high (app. 68%), suggesting that the majority of former athletes with verified contact participated in the study. Moreover, all information relied on self-report measures which limited our ability to analyze comprehensive medical record information or measures of biologically confirmed substance use. Given the sensitive nature of the collected information (depressive symptoms & substance use), responses may have been susceptible to social desirability bias, though the rates of opioid use, binge alcohol consumption, and depressive symptoms are similar to rates observed among other samples of retired contact sport athletes, including former NFL players (Latkin et al., 2017; Mannes et al., 2019). Despite these limitations, this study included measures assessing the different nuances of pain, including intensity, catastrophizing, and interference among NFL retirees. Findings from this study have relevant clinical implications that demonstrate the importance of intervening on pain catastrophizing in this population.

Given the results from this study, future empirical investigations would likely benefit from assessing pain catastrophizing when examining factors associated with pain functioning, depression, and HRQoL among retired NFL athletes. Though research examining the impact of concussions on depression among NFL athletes has important implications for elucidating the neuropathological mechanisms of this association, it is also important to identify salient, modifiable, psychological correlates of medical and psychiatric morbidities among NFL retirees. Continued identification of psychological aspects of pain and associated health outcomes will likely assist retired NFL athletes in reducing depressive symptoms, while improving functionality and HRQoL in this population.

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Table 1

Bivariate Associations between Pain Catastrophizing with Demographic and Career Information among Retired NFL Athletes (N=90)

Variable	<i>n</i> (% of Total)	PCS Mean (<i>SD</i>)	<i>p</i>
39–49	20 (22.22)	11.58 (15.14)	0.388
50–59	24 (26.67)	14.44 (13.13)	
60–69	38 (42.22)	11.96 (13.98)	
>70	8 (8.89)	7.00 (5.08)	
Race/Ethnicity			
Caucasian, Non-Hispanic	58 (64.44)	11.17 (11.77)	0.755
Nonwhite	32 (35.56)	12.10 (15.59)	
Education			
High School	10 (11.11)	14.60 (15.19)	0.745
College	64 (71.11)	11.53 (12.67)	
Graduate School or Equivalent	16 (17.78)	10.69 (13.87)	
Employment Status			
Unemployed	7 (7.78)	12.43 (7.65)	0.614
Employed	66 (73.33)	12.38 (14.30)	
Retired	17 (18.89)	8.88 (9.24)	
Marital Status			
Married	70 (77.78)	10.11 (10.79)	0.028
Non-married (Divorced, Widowed, Never Married)	20 (22.22)	17.35 (18.25)	
NFL Position			
Quarterback	6 (6.67)	3.50 (3.33)	0.518
Offensive/Defensive Line	28 (31.11)	13.79 (13.07)	
Fullback/Tight End	11 (12.22)	10.91 (9.70)	
Linebacker/Running Back	20 (22.22)	12.65 (12.52)	
Receiver/Defensive back	25 (27.78)	11.00 (15.84)	
NFL Career Duration (Games)			
1–49	22 (24.44)	9.68 (9.88)	0.094
50–99	27 (30.00)	16.15 (16.55)	
100–149	28 (31.11)	11.82 (13.04)	
150+	13 (14.44)	5.77 (5.21)	
Years of Retirement from NFL			
0–19	20 (22.22)	12.70 (15.49)	0.672
20–29	23 (25.56)	12.22 (12.39)	
30–39	39 (43.33)	12.05 (13.32)	
40–49	8 (8.89)	6.25 (5.65)	

Note. Bold values indicate significance at $p < 0.05$.

Table 2

Bivariate Associations between Pain Catastrophizing with Substance Use, Concussions, Pain Characteristics, Depressive Symptoms, & HRQoL among NFL Retirees (N=90)

Variable	<i>n</i> (% of Total) or <i>M</i> (<i>SD</i>)	PCS Mean (<i>SD</i>)	<i>p</i>
Substance Use			
Binge Alcohol			
No	66 (73.33)	11.52 (13.74)	0.805
Yes	24 (26.67)	12.29 (11.23)	
Marijuana			
No	76 (84.44)	10.70 (12.50)	0.137
Yes	14 (15.56)	17.29 (15.06)	
Opioids			
No	69 (76.67)	9.72 (11.50)	0.007
Yes	21 (23.33)	18.29 (15.82)	
Concussions	30.41 (49.11)		0.828
Pain Location^a			
Knee(s)			
No	45 (50.00)	9.16 (11.40)	0.062
Yes	45 (50.00)	14.29 (14.19)	
Back			
No	48 (53.33)	11.38 (13.55)	0.789
Yes	42 (46.67)	12.12 (12.62)	
Shoulder(s)			
No	55 (61.11)	8.85 (12.67)	0.008
Yes	35 (38.89)	16.23 (12.53)	
Neck			
No	72 (80.00)	11.38 (13.36)	0.617
Yes	18 (20.00)	13.11 (12.04)	
Hip(s)			
No	81 (90.00)	10.81 (12.72)	0.047
Yes	9 (10.00)	19.89 (13.97)	
Phalange(s)			
No	82 (91.11)	11.82 (13.17)	0.827
Yes	8 (8.89)	10.75 (12.73)	
Head/Headache			
No	83 (92.22)	10.86 (12.09)	0.029
Yes	7 (7.78)	22.00 (19.91)	
Pain Duration (Years)			
0–9	17 (18.89)	5.65 (11.26)	0.318
10–19	29 (32.22)	12.45 (13.42)	
20–29	13 (14.44)	14.46 (13.20)	
30–39	18 (20.00)	13.17 (14.25)	

Variable	<i>n</i> (% of Total) or <i>M</i> (<i>SD</i>)	PCS Mean (<i>SD</i>)	<i>p</i>
40+	13 (14.44)	13.31 (12.09)	
Pain Intensity	2.18 (2.40)		<0.001
Outcomes			
Pain Interference	2.54 (2.51)		<0.001
Depressive Symptoms			
None-Mild (<16)	63 (70.00)	7.38 (9.07)	<0.0001
Moderate-Severe (16)	27 (30.00)	21.85 (15.33)	
HRQoL			
Physical			
<40	34 (37.78)	20.38 (15.17)	<0.0001
40	56 (62.22)	6.46 (7.96)	
Mental			
<40	18 (20.00)	23.17 (16.92)	<0.0001
40	72 (80.00)	8.86 (10.20)	

Note.

^aParticipants could choose more than one option. Bold values indicate significance at $p < 0.05$.

Table 3

Multiple Linear Regression Examining the Association between Pain Catastrophizing and Pain Interference (N=90)

Variable	B	β	P	R ²
				0.706
Pain Catastrophizing	0.063	.327	< 0.001	
Pain Intensity	0.564	.538	< 0.001	
Opioid Use	0.554	.094	0.160	
Binge Alcohol Use	0.033	.006	0.924	
Concussion	-0.005	-.088	0.153	
Years Since NFL Retirement (10-year change)	0.129	.166	0.437	
Marital Status	0.394	.064	.330	

Note. Bold values indicate significance at $p < 0.05$.

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Table 4

Binomial Regression Analysis Examining the Association between Pain Catastrophizing and Moderate-Severe Depressive Symptoms (N=90)

Variable	OR (95% CI)	<i>p</i>	AOR (95% CI)	<i>p</i>
Pain Catastrophizing	1.10 (1.05–1.15)	<0.001	1.09 (1.02–1.15)	0.006
Pain Intensity	0.26 (0.05–1.40)	0.117	1.22 (0.90–1.66)	0.199
Opioid Use				
No	ref			
Yes	1.91 (0.74–4.88)	0.176	3.04 (0.80–11.66)	0.104
Binge Alcohol Use				
No	ref			
Yes	1.22 (0.29–5.20)	0.786	2.73 (0.77–9.64)	0.118
Concussions	0.76 (0.10–5.60)	0.796	1.00 (0.98–1.01)	0.915
Years of Retirement from NFL				
0–19	ref			
20–29	1.17 (0.33–4.19)	0.813	1.10 (0.19–6.33)	0.908
30–39	1.08 (0.33–3.49)	0.902	0.90 (0.19–4.38)	0.897
40–49	0.33 (0.03–3.33)	0.350	0.80 (0.06–11.19)	0.867
Marital Status				
Unmarried	ref			
Married	2.06 (0.77–5.49)	0.149	0.55 (0.10–2.95)	0.488

Note. Bold values indicate significance at $p < 0.05$.

Table 5

Binomial Regression Examining Association between Pain Catastrophizing with Physical and Mental HRQoL (N=90)

Variable	Physical HRQoL				Mental HRQoL			
	OR (95% CI)	p	AOR (95% CI)	p	OR (95% CI)	p	AOR (95% CI)	p
Pain Catastrophizing	0.90 (0.85–0.95)	<0.001	0.88 (0.81–0.96)	0.003	0.92 (0.89–0.96)	<0.001	0.94 (0.88–0.99)	0.029
Pain Intensity	0.60 (0.47–0.77)	<0.001	0.82 (0.58–1.60)	0.264	0.65 (0.52–0.83)	<0.001	0.72 (0.52–1.01)	0.056
Opioid Use	ref				ref			
No	0.08 (0.02–0.26)	<0.001	0.06 (0.01–0.33)	0.001	0.38 (0.13–1.15)	0.088	0.67 (0.15–3.01)	0.604
Yes								
Binge Alcohol								
No	ref				ref			
Yes	1.02 (0.39–2.66)	0.974	1.41 (0.36–5.59)	0.620	0.67 (0.22–2.04)	0.476	0.46 (0.10–2.02)	0.306
Concussions	1.01 (0.99–1.02)	0.338	1.01 (0.99–1.04)	0.221	1.00 (0.99–1.01)	0.978	1.00 (0.99–1.02)	0.959
Years of NFL Retirement								
0–19	ref				ref			
20–29	0.41 (0.11–1.64)	0.211	0.07 (0.01–0.97)	0.048	1.27 (0.31–5.20)	0.743	2.58 (0.34–19.67)	0.360
30–39	0.28 (0.08–0.99)	0.048	0.09 (0.01–0.97)	0.047	1.77 (0.47–6.76)	0.399	2.65 (0.46–15.21)	0.272
40–49	0.42 (0.70–2.53)	0.341	0.05 (0.00–1.04)	0.053	1.00 (0.15–6.64)	0.999	0.44 (0.04–4.27)	0.479
Marital Status								
Unmarried	ref				ref			
Married	0.68 (0.25–1.86)	0.451	0.67 (0.13–3.49)	0.636	0.35 (0.11–1.06)	0.064	1.14 (0.21–6.30)	0.878

Note. Bold values indicate significance at $p < 0.05$.