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History of Opioid Use as a Risk Factor for Current Use and Mental Health Consequences among Retired National Football League Athletes: A 9-Year Follow-up Investigation

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Abstract

Background: Many retired National Football League (NFL) athletes manage pain with opioids during their playing careers and in retirement, though the longitudinal association between opioid use and health outcomes pertinent to an NFL career are not yet known. This study aimed to assess the relationship between opioid use in 2010 and current use, depressive symptoms, and health related quality of life (HRQoL) among NFL retirees.

Methods: Former NFL athletes from the Retired NFL Players Association initially recruited in 2010 for a study examining risk factors of opioid use and misuse were re-contacted (N=89) from 2018 to 2019 and administered measures of pain, opioid use, depressive symptoms, and HRQoL. Binomial regression examined the association between 2010 opioid use with current use,

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Contributors

All authors contributed significantly to study conceptualization and design. Authors Mannes, Dunne, Ennis, and Cottler were responsible for data analysis and interpretation of the data. Authors Mannes, Dunne, and Ferguson drafted the manuscript, while Ennis and Cottler evaluated and revised the manuscript. All authors contributed to, and have approved the final manuscript.

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Conflict of Interest
No conflict declared.

moderate-severe depressive symptoms, and average and above HRQoL (physical and mental) while controlling for covariates.

Results: Nearly 50% of retirees using opioids in 2010 currently used. Compared to non-users, retirees who used opioids in 2010 had greater odds of current use (AOR: 3.71, 95% CI: 1.02-13.56, $p=0.046$) and experiencing moderate-severe depressive symptoms (AOR: 5.93, 95% CI: 1.15-30.54, $p=0.033$). Retirees reporting use in 2010 also evidenced lower odds of reporting average or above mental HRQoL (AOR: 0.13, 95% CI: 0.03-0.67, $p=0.015$) compared to non-users.

Conclusions: This study showed that among NFL retirees, early retirement opioid use predicted current use and deleterious effects on mental health, including moderate-severe depressive symptoms approximately nine years later. This investigation further supports the importance of early intervention of pain and opioid use among this population.

Keywords

National Football League; NFL; opioid use; pain; depression; mental health

1. Introduction

Elite athletes engaging in high impact collision sports, particularly American football, experience high rates of injury, acute pain, and medical conditions contributing to chronic pain, factors which may lead to deleterious mental health consequences in retirement (Mannes et al., 2019). Epidemiological data suggest that National Football League (NFL) athletes experience injuries at a rate of 395.8 per 1000 athletes, which is significantly greater than other high contact sports, such as rugby and ice hockey (Lawrence et al., 2015). Most common injuries occur in the lower extremities, including knees (12.4%) and ankles (8.7%), while concussions account for 7% of injuries (Lawrence et al., 2015). The latter is particularly concerning given the growing body of evidence implicating brain injuries as a contributor to neuropsychiatric symptoms among former professional football players (McKee et al., 2009). Up to one-third of NFL retirees report moderate-severe depressive symptoms, with prevalence rates increasing threefold for those who report three or more concussions (Didehbani et al., 2013; Guskiewicz et al., 2007; Kerr et al., 2012; Mannes et al., 2020).

Management of injuries and pain among NFL athletes during their playing careers has received increased attention due to two critical areas of research: repeated head injury and chronic traumatic encephalopathy (CTE), as well as the prescription opioid epidemic (McKee et al., 2009; Wilkerson et al., 2016). While acute pain is a life-sustaining biological response to injury and tissue damage, chronic pain is a condition that is often accompanied by physical and psychological suffering, helplessness, and maladaptive coping responses (Fishbain et al., 1997). Acute pain associated with significant injuries (e.g., bone fractures or dislocations) is likely to benefit from short-term pain management with prescription medication, while opioid use is contraindicated for chronic pain (Zideman et al., 2018). The prescription opioid epidemic is responsible for nearly 230,000 deaths in the past two decades with the highest prevalence and burden of opioid-related deaths occurring among

men aged 25 to 34 (CDC, 2020, Gomes et al., 2018). This is concerning as this demographic is consistent with the playing age for most NFL athletes, who already experience significant injuries and exposure to prescription opioids for pain management. Chronic pain conditions, such as osteoarthritis, can linger beyond the playing career, with as many as 80% of retired football players continuing to report the experience of daily joint pain (Weir, Jackson, & Sonnega, 2009).

The literature on pain and depression reveals a complex bidirectional relationship, such that chronic pain negatively impacts mood and quality of life, while depression can intensify the experience of pain symptoms and interfere with pain management strategies (Sullivan, 2018; Elliot, Renier, & Palcher, 2003). In fact, chronic pain patients experiencing depressive symptoms were less likely to benefit from opioid analgesia and more likely to engage in opioid misuse behavior compared to pain patients without psychiatric comorbidities (Wasan et al., 2015). Pain and opioid use can also affect health related quality of life (HRQoL) through decreased engagement in pleasurable social activities, occupational disruptions, and functional limitations including difficulties with activities of daily living (Liechtenstein et al., 1998; Dueñas et al., 2016.)

In an effort to understand the difficulties of pain and opioid use experienced by NFL retirees, Cottler and colleagues (2011) completed the first investigation examining the rates and risk factors of opioid use and misuse among this population. Their study of 644 NFL retirees found high rates of current opioid misuse compared to the general population (i.e., 7% vs 1.6%) and concluded that concussions, more severe pain intensity, and heavy alcohol use were associated with current use (Cottler et al., 2011). It was further documented that retired players continued to experience negative health consequences resulting from their playing careers, with only 13% of the sample describing their current health as “excellent” and many retirees endorsing physical and mental health impairments (Cottler et al., 2011). Given these findings, prospective studies that examine health outcomes for NFL retirees across the lifespan are needed. The current study aimed to take the next step towards this research goal by examining the longitudinal association between 2010 opioid use and current use, depressive symptoms, and HRQoL among this cohort of retired NFL athletes. We hypothesized that former NFL athletes using opioids in 2010 would evidence greater odds of engaging in current use and experiencing moderate to severe depressive symptoms, as well as lower odds of having average or above physical and mental HRQoL.

2. Materials and Methods

2.1. Sample and Design

The study was approved by the University of Florida (UF) Institutional Review Board and was based on Cottler and colleagues (2011) investigation examining the prevalence and risk factors of opioid use and misuse among 644 members of the Retired NFL Players Association who played American football from 1967-2004. The study recruited participants in 2010 and the final manuscript was published in 2011. Though the original investigation was conducted at Washington University in St. Louis, UF was granted approval to recontact the NFL cohort following relocation of several study investigators to the University.

As part of an ongoing effort to continue to examine mental and physical health outcomes among this cohort of retired NFL athletes, former players who consented to being re-contacted during initial collection were recruited via telephone by trained research assistants in 2018-2019. This study utilized similar measures of injury, pain, and opioid use as the 2010 investigation, as well as assessed current substance use (i.e., opioids, cannabis, & alcohol), symptoms of depression, and HRQoL. For this investigation, study staff attempted to contact each NFL retiree on a provided home or mobile telephone number, and messages were left for those unavailable if they had an active voicemail. If contact with an NFL retiree was made, a standardized script was utilized that provided information pertaining to the content, rationale, and 15-30 minute duration of the current study. The interviewer also reminded each retired athlete of their participation in the Cottler et al., 2011 investigation and their willingness to be re-contacted at a future date. After consent was provided by the participant, research assistants administered study measures. Collected information was subsequently entered into Research Electronic Data Capture (REDCap) software, de-identified, and replaced with the identification number that was assigned to each retired athlete during initial data collection in 2010. Of the 644 original athletes who participated in the 2010 investigation, 17 were identified as deceased and 294 had a disconnected or inaccurate telephone number. With multiple contact attempts, 132 retirees were reached, of which 18 declined, 24 deferred and did not complete study measures, and 90 participated and completed all study measures. One participant was excluded in the analyses as a result of missing 2010 data.

2.2. Measures

2.2.1. Primary Exposure—2010 Opioid Use: The original investigation assessed opioid use via the Washington University Risk Behavior Assessment, which measured past 30-day use and misuse (i.e., prescribed opioid medications used in a way other than prescribed, more than prescribed, or after the prescription ended). To assist NFL retirees in identifying whether they were currently using an opioid analgesic, the generic and brand names of commonly prescribed opioids were provided (i.e., hydrocodone [Vicodin®] oxycodone [OxyContin®, Percocet®] oxymorphone [Opana®], morphine [Kadian®, Avinza®], hydromorphone [Dilaudid®], codeine, fentanyl, etc.). Retirees reporting any past 30-day opioid use in 2010 were categorized as opioid users.

2.2.2. Primary Outcomes

Current Opioid Use: The Washington University Risk Behavior was modified from past 30 day to past 12-month opioid use and misuse after being asked about lifetime. A similar list of opioid analgesics was used. Retirees who reported using prescribed or non-prescribed opioids in the past 12-months were categorized as opioid users.

Depressive Symptoms: Depressive symptoms were measured using The Center for Epidemiologic Studies Depression Scale (CES-D). Participants reported depressive symptoms over the past seven days with responses on the 20 items ranging from “0” (rarely or none) to “3” (most, or all the time; Radloff, 1977). Higher scores reflect elevated depression symptomatology. The CES-D has demonstrated good reliability and validity, particularly among adults who have pain and painful medical conditions (Cosco et al., 2017;

Milette et al., 2010). Based on total scores, NFL retirees were classified as follows: none/mild depressive symptoms (0-15) and moderate-severe symptoms (16). This cutoff score is recommended by the original scoring guidelines and has exhibits strong sensitivity (87%) and adequate specificity (70%; Radloff, 1977; Vilagut et al., 2016).

HRQoL: HRQoL was measured with the Medical Outcomes Study Short Form 12-Item (SF-12), which yields two composite scores (mental and physical HRQoL) from several subdomains, including general health, physical functioning, role physical, bodily pain, vitality, social functioning, role emotional, and mental health. Consistent with SF-12 scoring guidelines, the total composite scores were standardized to a T-score distribution with a mean of 50 and a SD of 10 (Jenkinson et al., 1997). Mental and physical HRQoL was classified as: low (<40) to indicate retirees scoring less than 1 SD below the mean and average or above (≥ 40). The SF-12 demonstrates strong psychometrics in individuals with pain and depression (Hayes et al., 2017; Huo et al., 2018; Luo et al., 2003).

2.2.3 Covariates—Covariates included variables from 2010 and 2019 associated with opioid use, depressive symptoms, and HRQoL among NFL retirees and general medical patients. Covariates assessed in 2010 included disability status (no, yes), perceived health (poor, fair, good, excellent), and pain intensity (0=no pain to 10=pain as bad as you can imagine) while 2019 covariates included sociodemographics (age, race [White, Non-White], marital status [non-married, married], employment status [unemployed, employed, retired], perceived financial difficulties [no, yes]), total concussions (diagnosed & undiagnosed), current pain intensity (0=no pain to 10=pain as bad as you can imagine), number of years living with pain (i.e., pain duration), and NFL career information (total games played, years since NFL retirement, and NFL position, including offense lineman [OL] /defensive lineman [DL], quarterback [QB], running back [RB]/linebacker [LB], wide receiver [WR] /defensive back [DB], fullback [FB]/tight end [TE]). Current substance use was also assessed, including past 12-month cannabis use (no, yes) and binge drinking (no, yes) defined by consuming 5 or more alcoholic drinks on at least one occasion during the past 30 days, in line with the definition established for men by the National Institute on Alcohol Abuse and Alcoholism.

2.3. Statistical Analyses

All analyses were performed in IBM SPSS Version 25 (SPSS, Version 25; IBM, Armonk, NY). Descriptive statistics were calculated for sample sociodemographics, substance use, pain variables, and NFL career information. The sample was subsequently stratified based on 2010 opioid use (use vs no use) and bivariate comparisons were conducted using Chi-Square and independent sample t-tests to assess for potential differences in covariates and the primary outcomes of current opioid use, moderate-severe depressive symptoms, and HRQoL. To further evaluate the relationship between 2010 opioid use and the outcomes of interest, binomial regressions were fit utilizing non-users as the designated referent group. All analyses controlled for potential confounding variables (i.e., total concussions, race) that were significantly associated with 2010 opioid use in bivariate analysis ($p < 0.05$), as well as current pain intensity, pain duration (years), binge alcohol use, and years of retirement, all

factors associated with primary outcomes supported by the sport medicine and general medical population literature. We presented adjusted odds ratios with 95% confidence limits.

3. Results

3.1. Sample Characteristics

The sample ($N = 89$) had a mean age of 57.68 years ($SD = 9.94$), most identified as non-Hispanic, White (64.0%), employed (73.0%), and the 77.5% designates people who are indeed married. The majority of the sample played OL/DL (31.5%) and retired NFL athletes averaged 90.53 ($SD = 55.42$) NFL games played as well as 28.83 ($SD = 8.68$) years since NFL retirement. In regard to pain and injury, 11.2% of the current sample was on disability in 2010, and retirees experienced 30.41 ($SD = 49.11$) concussions, 20.65 ($SD = 13.98$) years living with pain, and mild (i.e., 2.86 [$SD = 2.38$]) current pain intensity. Approximately 23.6%, 15.7%, 27.0%, and of the sample reported past 12-month opioid use, past 12-month cannabis use, and past 30-day binge drinking, respectively. Over 30% of the sample experienced moderate-severe depressive symptoms over the past week and nearly 50% of retirees who used opioids in 2010 currently used.

3.2. Bivariate Associations between 2010 Opioid Use, Current Use, Moderate-Severe Depressive Symptoms, and Average-Above HRQoL

Chi-square analyses indicated that NFL retirees who used opioids in 2010 were more likely to be White ($\chi^2 = 5.34$, $p = 0.021$) and report a greater number of lifetime concussions, $t(86) = -1.56$, $p = 0.011$. Additionally, retired athletes reporting 2010 opioid use were more likely to currently use opioids ($\chi^2 = 6.47$, $p = 0.011$), experience current symptoms of moderate-severe depression ($\chi^2 = 8.07$, $p = 0.005$), and have significantly lower mental HRQoL ($\chi^2 = 5.71$, $p = 0.017$) in 2019 compared to retired athletes that did not use opioids in the baseline study (Table 1).

3.3. Association between 2010 Opioid Use and Current Use

All multivariate analyses examining the association between 2010 opioid use and the examined health outcomes controlled for current pain intensity, binge drinking, total lifetime concussions, pain duration, years since NFL retirement, and race. Binomial regression analysis assessed the association between 2010 opioid use and current use. Retirees who used opioids in 2010 (vs no use) exhibited greater odds of current use (*OR*: 4.03, 95% *CI*: 1.31-12.48, $p = 0.015$). In multivariate analysis, the overall model was significant, $\chi^2(7) = 16.67$, $p = 0.020$, and explained 25.90% of the variance in opioid use. Past opioid use (*AOR*: 3.71, 95% *CI*: 1.02-13.56, $p = 0.046$) was the only variable associated with current use in the adjusted model (Table 2).

3.4. Association between 2010 Opioid Use and Moderate-Severe Depressive Symptoms

Binomial regression analysis assessed the association between 2010 opioid use and past week moderate-severe depressive symptoms. Retirees using opioids in 2010 (vs no use) evidenced greater odds of reporting current moderate-severe depressive symptoms in unadjusted analysis (*OR*: 3.17, 95% *CI*: 1.02-9.90 $p = 0.046$). After accounting for covariates, the overall model was significant, $\chi^2(7) = 29.17$, $p < 0.001$, and explained

40.10% of the variance in moderate-severe depressive symptoms. Opioid use in 2010 (*AOR*: 5.93, 95% *CI*: 1.15-30.54, $p=0.033$) remained associated with moderate-severe depressive symptoms in the adjusted model (Table 3).

3.5. Association between 2010 Opioid Use and Average and Above HRQoL

Binomial regression analysis assessed the association between 2010 opioid use with average or above (40) mental and physical HRQoL. Opioid use was negatively associated with average and above mental HRQoL (*OR*: 0.25, 95% *CI*: 0.08-0.82, $p=0.022$). The overall model including 2010 opioid use and covariates was significant, $\chi^2(7) = 24.61$, $p=0.001$, accounting for 39.0% of variance in mental HRQoL. Retirees reporting 2010 opioid use exhibited lower odds of reporting average or above mental HRQoL (*AOR*: 0.13, 95% *CI*: 0.03-0.67, $p=0.015$) than retirees who did not report baseline opioid use. Opioid use was not associated with physical HRQoL (*OR*: 0.85, 95% *CI*: 0.29-2.52, $p=0.779$; Table 4).

4. Discussion

This prospective study examined the association between 2010 opioid use and current use, depressive symptoms, and HRQoL among a sample of 89 retired NFL athletes. In line with the authors' hypotheses, retirees who used opioids in 2010 were more likely to engage in current use, as well as experience moderate-severe depressive symptoms, and below average mental HRQoL compared to non-opioid users approximately nine years later. Baseline opioid use was not associated with physical HRQoL. Building upon results from Cottler and colleagues (2011) cross-sectional investigation, findings from this study have important clinical implications of NFL retirees and support the importance of early intervention for pain and opioid use among this population.

Of the 50% of athletes that use opioids during their NFL career, 71% report misuse and many continue to use in retirement in an effort to manage longstanding pain (Cottler et al., 2011). Though substance use trajectories were not assessed in this study, findings showed that opioid use persisted into later retirement, as nearly half of NFL retirees using opioids in 2010 reported current use. Moreover, 2010 opioid use was the only factor associated with current use after controlling for covariates. One explanation for these findings may be related to the age of onset of opioid use, a robust clinical indicator of future use and severity (Sharma, Bruner, Barnett, & Fishman, 2016). Adolescent American football players experience a high rate of painful injuries and demonstrate 50% greater likelihood of non-medical opioid use compared with non-football participating peers (Kerr et al., 2017; Veliz, Boyd, & McCabe, 2013). For those athletes continuing football participation at the collegiate and professional level, further exposure to bodily injury and opioid use occur (Ford et al., 2018). Due to early exposure and continued use throughout an NFL career, opioids have likely been normalized and reinforced as an effective pain management strategy. This may be particularly true for a cohort of retired NFL athletes that were overprescribed opioids during their playing careers prior to the dissemination of robust evidence demonstrating the contraindication of opioid use for chronic pain. Anecdotal reports provided by several participants that were currently using opioid medications expressed concern that their opioids were ineffective in treating their pain, though they

continued to use due to a perceived lack of alternative pain management strategies. Continued reliance on opioids despite ambivalence about the benefits, and maladaptive beliefs about non-pharmacologic therapies have been documented among Veterans, a cohort demonstrating medical and psychosocial characteristics similar to that of NFL retirees (Simmonds et al., 2015).

This study indicated a significant association between opioid use, depressive symptoms, and low mental HRQoL. Regarding mechanisms for this association, it is plausible that use of opioids leads to the development of mood disorders (precipitation hypothesis), mood disorders lead to opioid use (self-medication hypothesis), and/or a third factor contributes to vulnerability to both opioid use and mood disorders (Martins et al., 2011). The precipitation hypothesis postulates that use of opioids contributes to psychosocial and neurological consequences that can lead to the development of mood disorders (Martins et al., 2011; Sarvet & Hassin, 2016). Opioid use is a well-documented risk factor for major depressive disorder, bipolar disorder(s), and generalized anxiety disorder (Martins et al., 2011). This phenomenon is supported in chronic pain patients, as use of opioids in greater doses and for longer duration is associated with developing clinical depression via functional connectivity alterations in the nucleus accumbens and amygdala, regions of the brain associated with mood and emotion regulation (Cahill et al., 2016; Scherrer et al., 2016; Upadhyay et al., 2010). Psychosocial mechanisms have also been implicated in developing depression among opioid users. Escalating opioid use may lead to medical, occupational, financial, social, relational, and legal consequences, contributing to the development of depressive symptoms. Long-term opioid use can also lead to greater pain sensitivity, which may also exacerbate mood symptoms (Edwards et al., 2011; Zhang et al., 2015).

Alternatively, NFL athletes may also be self-medicating their physical and emotional pain through use of opioids, which could further explain the association between 2010 opioid use and negative mental health symptoms observed in this study. The self-medication hypothesis suggests that substance use may serve as a coping strategy for relieving psychiatric symptoms, and this may eventually result in increased reliance on substance use and/or the development of a substance use disorder (Khantzian, 1997). Accordingly, it is possible that NFL retirees in this sample may have difficulty managing symptoms of negative affect, leading them to seek continued relief from distress through opioids. Finally, rather than considering the causality of the mood disorder-opioid use relationship, the shared vulnerability model suggests there may be a third factor (e.g. pain, genetic liability, environmental stressors) that increases risk for both mood disorders and opioid use. This model is supported by behavioral genetic studies and indicates that further research may be necessary to identify factors that may be indirectly responsible for the observed relationship between opioid use and depressive symptoms among NFL retirees in this study (Kendler et al., 2003; Lyons et al., 2008). Future research should also build upon the findings of this study by clarifying the causality of the association between mood disorder symptoms and opioid use among NFL retirees, which could have significant implications for prevention and treatment.

Though this study has notable strengths, several limitations should be considered when interpreting the results. First, the follow-up sample size was modest compared to the original

Cottler et al., investigation and restricted the examination of additional covariates in multivariate analyses. The confidence intervals for the studied outcomes yielded a wide effect, particularly for moderate-severe depressive symptoms, and this was likely due to sample size limitations. Thus, careful consideration should be given when interpreting the results. Moreover, opioid use in 2010 was the primary exposure and authors were unable to distinguish differences between retirees who were misusing and using as prescribed. Misusers may experience more severe medical and psychological sequelae, though opioid use as prescribed also contributes to deleterious mental health consequences and can lead to depression (Salas et al., 2018; Scherrer et al., 2014; Scherrer et al., 2016). Lastly, measures of substance use and depressive symptoms may be susceptible to social desirability bias and lead to non-report of these symptoms. Despite these limitations, this study elucidated associations between previous opioid use and current use, moderate-severe depressive symptoms, and mental HRQoL among retired NFL athletes. To the author's knowledge, this is the first prospective study examining the effects of opioid use on health outcomes among a cohort of retired NFL athletes.

5. Conclusions

The current investigation showed that among NFL retirees, earlier retirement opioid use was associated with greater risk of current use and deleterious effects on mental health, including moderate-severe depressive symptoms. This investigation contributes to the literature by identifying opioid use as a risk factor for adverse health outcomes among retired NFL athletes, a population susceptible to high rates of injury, pain, mental health symptoms, and early opioid use-exposure (Mannes et al., 2019). Though several studies involving elite athletes have utilized prospective or longitudinal designs to examine risk factors of mental health symptoms among retired NFL athletes, additional investigations are needed to assess the trajectories, risk factors, and health consequences of substance use and misuse among NFL athletes (Kerr, Marshall, Harding Jr, & Guskiewicz, 2012; Kerr et al., 2018). Moreover, though high rates of concussion, pain, substance use, and depressive symptoms are well documented in this population, there is an immense dearth of clinical research involving NFL retirees. Randomized controlled trials are needed in order to determine the most effective methods by which healthcare professionals can detect and treat these symptoms among retired NFL athletes. Given the findings from this study, early detection and robust opioid mitigation interventions may help to improve the long-term health of this at-risk population.

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Highlights

- The longitudinal association between 2010 opioid use and current health outcomes was examined among NFL retirees.
- Nearly 50% of retirees reporting opioid use in 2010 reported current use.
- 2010 opioid use was associated with current use, depressive symptoms, and poor mental HRQoL.
- Early intervention of pain and opioid use among NFL retirees is needed.
- Modest sample size and self-report data should be considered as limitations.

Table 1.

Differences in Baseline and Follow Up Sociodemographics, Pain, Substance Use, and Depressive Symptoms among NFL Retirees Reporting Opioid Use in 2010 (n=89)

Variable	No Opioid Use (n=72) M (SD) or N	2010 Opioid Use (n=17) M (SD) or N	Total (N=89) M (SD) or N	<i>p</i>
Sociodemographics				
Age	57.24 (10.21)	59.12 (8.98)	57.68 (9.94)	0.111
Race				
White	42 (58.3)	15 (88.2)	57 (64.0)	0.021
Non-White	30 (41.7)	2 (11.8)	32 (36.0)	
Employment				
Unemployed	4 (5.6)	3 (17.6)	7 (7.9)	0.249
Employed	54 (75.0)	11 (64.7)	65 (73.0)	
Retired	14 (19.4)	3 (17.6)	17 (19.1)	
Current Financial Difficulties				
No	60 (83.3)	16 (94.1)	76 (85.4)	0.257
Yes	12 (16.7)	1 (5.9)	13 (14.6)	
Current Marital Status				
Married	55 (76.4)	14 (82.4)	69 (77.5)	0.596
Non-married	17 (23.6)	3 (17.6)	20 (22.5)	
Injury, Pain, & Health Status				
2010 Disability Status				0.074
No	66 (91.7)	13 (76.5)	79 (88.8)	
Yes	6 (8.3)	4 (23.5)	10 (11.2)	
2010 Pain Intensity	5.33 (1.97)	6.24 (2.63)	5.52 (2.14)	0.117
2010 Health Status				
Poor	8 (11.1)	1 (5.9)	9 (10.1)	0.126
Fair	36 (50.0)	4 (23.5)	40 (44.9)	
Good	20 (27.8)	8 (47.1)	28 (31.5)	
Excellent	8 (11.1)	4 (23.5)	12 (13.5)	
Pain Duration (Years)	20.59 (14.40)	21.24 (1.69)	20.65 (13.98)	0.572
Current Pain Intensity	2.88 (2.37)	2.94 (2.46)	2.86 (2.38)	0.429
Concussions	23.36 (35.93)	47.05 (85.15)	30.41 (49.11)	0.011
Substance Use				
Current Cannabis Use				
No	62 (86.1)	13 (76.5)	75 (84.3)	0.326
Yes	10 (13.9)	4 (23.5)	14 (15.7)	
Current Binge Alcohol Use				
No	54 (75.0)	11 (64.7)	65 (73.0)	0.390
Yes	18 (25.0)	6 (35.3)	24 (27.0)	
Current Opioid Use				
No	59 (81.9)	9 (52.9)	68 (76.4)	0.011
Yes	13 (18.1)	8 (47.1)	21 (23.6)	

Variable	No Opioid Use (n=72) M (SD) or N	2010 Opioid Use (n=17) M (SD) or N	Total (N=89) M (SD) or N	<i>p</i>
Mental Health				
Depressive Symptoms				
None-Mild	55 (76.4)	7 (41.2)	62 (69.7)	0.005
Moderate-Severe	17 (23.6)	10 (58.8)	27 (30.3)	
HRQoL				
Mental				
Low	11 (15.3)	7 (41.2)	18 (20.2)	0.017
Average or Above	61 (84.7)	10 (58.8)	71 (79.8)	
Physical Low	27 (37.5)	7 (41.2)	34 (38.2)	0.779
Average or Above	45 (62.5)	10 (58.8)	55 (61.8)	
NFL Career Information				
Number of Games Played	93.64 (58.06)	77.35 (43.73)	90.53 (55.42)	0.216
Years Since NFL Retirement	28.17(8.65)	31.06 (8.55)	28.83 (8.68)	0.620
NFL Position				
QB	6 (8.3)	0 (0.0)	6 (6.7)	0.111
OL/DL	23 (31.9)	5 (29.4)	28 (31.5)	
FB/TE	6 (8.3)	5 (29.4)	11 (12.4)	
LB/RB	18 (25.0)	2 (11.8)	20 (22.4)	
WR/DB	19 (26.4)	5 (29.4)	24 (30.0)	

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

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Table 2.

Logistic Regression Examining the Association between 2010 Opioid Use and Current Use (N=89)

Variable	OR (95% CI)	<i>p</i>	AOR (95% CI)	<i>P</i>
Opioid Use				
No	ref		ref	
Yes	4.03 (1.31-12.48)	0.015	3.71 (1.02-13.56)	0.046
Pain Intensity	1.21 (0.98-1.490)	0.065	1.24 (0.95-1.63)	0.177
Binge Alcohol Use				
No	ref			
Yes	1.13 (0.38-3.36)	0.822	0.65 (0.17-2.50)	0.528
Concussions	0.99 (0.99-1.01)	0.723	0.99 (0.98-1.00)	0.575
Pain Duration	1.04 (1.00-1.08)	0.035	1.03 (0.98-1.08)	0.212
Years of Retirement	1.05 (0.99-1.11)	0.121	0.99 (0.92-1.07)	0.841
Race				
White	ref			
Non-White	0.23 (0.06-0.85)	0.028	0.22 (0.045-1.10)	0.065

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

Table 3.

Logistic Regression Examining the Association between 2010 Opioid Use and Moderate-Severe Depressive Symptoms (N=89)

Variable	OR (95% CI)	<i>p</i>	AOR (95% CI)	<i>P</i>
Opioid Use				
No	ref		ref	
Yes	3.17 (1.02-9.90)	0.046	5.93 (1.15-30.54)	0.033
Pain Intensity	1.74 (1.33-2.36)	<0.001	2.16 (1.42-3.29)	<0.001
Binge Alcohol Use				
No	ref			
Yes	2.25 (0.78-6.46)	0.132	3.23 (0.60-17.42)	0.171
Concussions	1.00 (1.00-1.01)	0.403	1.00 (0.99-1.02)	0.278
Pain Duration	1.02 (0.99-1.06)	0.250	0.99 (0.89-1.10)	0.759
Years of Retirement	0.99 (0.93-1.04)	0.604	0.99 (0.89-1.10)	0.872
Race				
White	ref			
Non-White	2.18 (0.79-5.99)	0.131	1.90 (0.35-10.18)	0.454

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

Table 4.

Logistic Regression Examining the Association between 2010 Opioid Use and HRQoL (N=89)

Variable	Physical HRQoL				Mental HRQoL			
	OR (95% CI)	<i>p</i>	AOR (95% CI)	<i>P</i>	OR (95% CI)	<i>p</i>	AOR (95% CI)	<i>p</i>
Opioid Use								
No	ref				ref			
Yes	0.85 (0.29-2.52)	0.779	1.05 (0.24-4.56)	0.944	0.25 (0.08-0.82)	0.022	0.13 (0.03-0.67)	0.015
Pain Intensity	0.60 (0.47-0.77)	<0.01	0.62 (0.48-0.79)	<0.01	0.65 (0.52-0.83)	<0.01	0.66 (0.51-0.86)	0.002
Binge Alcohol								
No	ref				ref			
Yes	1.02 (0.39-2.66)	0.974	1.80 (0.50-6.43)	0.368	0.67 (0.22-2.04)	0.476	0.99 (0.22-4.58)	0.992
Concussions	1.01 (1.00-1.02)	0.338	1.01 (0.99-1.02)	0.267	1.00 (0.99-1.01)	0.978	1.00 (0.99-1.02)	0.580
Pain Duration	0.95 (0.92-0.98)	0.003	0.96 (0.92-1.01)	0.082	0.99 (0.95-1.02)	0.475	0.97 (0.91-1.04)	0.393
Years of NFL Retirement	0.96 (0.91-1.01)	0.118	0.98 (0.92-1.07)	0.752	1.02 (0.96-1.08)	0.542	1.04 (0.94-1.15)	0.414
Race								
White	ref				ref			
Non-White	1.26 (0.51-3.08)	0.621	1.68 (0.49-5.80)	0.413	0.47 (0.17-1.34)	0.157	0.45 (0.09-2.27)	0.334

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