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Pain catastrophizing and pain acceptance are associated with pain severity and interference among methadone-maintained patients

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Abstract

Objective: The present study examined whether pain catastrophizing and pain acceptance, two important targets of psychosocial interventions for chronic pain, are uniquely associated with pain severity and pain interference among patients on methadone maintenance treatment (MMT).

Method: A total of 133 MMT patients who reported experiencing some pain during the previous week completed a battery of self-report measures. Multiple regression was used to test whether pain catastrophizing and pain acceptance are related to pain severity and pain interference above and beyond covariates including demographics, emotional distress, and current methadone dose.

Results: Both pain acceptance and catastrophizing were significantly associated with pain severity and pain interference while controlling for covariates.

Conclusions: Consistent with previous literature on patients with chronic pain but without opioid use disorder, our findings suggest that both pain catastrophizing and pain acceptance are potentially important intervention targets among MMT patients with co-occurring opioid use disorder and chronic pain.

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Conflict of Interest

The authors have no conflicts of interest in conducting this research.

Keywords

opioid use disorder; methadone maintenance; pain; pain catastrophizing; pain acceptance

Introduction

Untreated opioid use disorder (OUD) is an important contributor to the current opioid crisis (Kolodny et al., 2015). Although *methadone* is an effective FDA-approved medication for OUD treatment and has been widely used as a medication-assisted treatment strategy (Schuckit, 2016), the high rates of pain complicate optimal OUD treatment delivery. For instance, it is estimated that 37% to more than 60% of patients with methadone maintained treatment (MMT) for OUD have chronic pain (Barry, Beitel, Garnet, et al., 2009; Dunn, Brooner, & Clark, 2014; Ilgen, Trafton, & Humphreys, 2006; Jamison, Kauffman, & Katz, 2000; Voon et al., 2015). Further, MMT patients with chronic pain compared to those without chronic pain are at significantly higher risk for having complex psychiatric conditions and opioid agonist treatment non-retention (Barry et al., 2009b; Berg et al., 2009; Bounce et al., 2013; Larson et al., 2007). Furthermore, in comparison to patients with chronic pain alone, those with co-occurring OUD chronic pain have higher rates of non-opioid substance use disorders (Barry et al., 2016).

Patients entering MMT with chronic pain report using illicit opioids to manage pain (Barry et al., 2009), and both patients and providers desire an integrated treatment approach that addresses both conditions (Barry et al., 2008, 2009, 2013). However, studies to date on managing chronic pain in MMT have focused on pharmacotherapy, and have largely ignored the possible role of integrated psychosocial interventions in promoting self-management of pain (Alford, Barry, & Fiellin, 2013; Barry et al., 2009; Barry et al., 2014). There is also a current paucity of evidence-based psychosocial pain interventions that are designed for MMT patients (Barry et al., 2019). As a result, treatments for patients with OUD and chronic pain have been usually fragmented, and many patients do not receive adequate treatment for either chronic medical condition (Becker & Barry, 2019). Thus, an important first step to address this gap is to examine whether common targets of psychosocial pain interventions that are designed for individuals with chronic pain but not with OUD are associated with important pain-related variables (e.g., pain severity and pain interference; Dworkin et al., 2005) among MMT patients.

Cognitive-behavioral therapy (CBT) and acceptance-commitment therapy (ACT) are two major evidence-based psychosocial interventions for chronic pain (Ehde, Dillworth, & Turner, 2014; Veehof, Oskam, Schreurs, & Bohlmeijer, 2011). Some of the key clinical targets of these treatments are catastrophizing and acceptance, respectively (Ehde et al., 2014; McCracken & Vowles, 2014; Ruiz, 2010). *Pain catastrophizing* is a maladaptive cognitive and affective reaction to pain characterized by magnification, helplessness, and rumination (Sullivan et al., 2001). Copious evidence suggests robust positive associations between pain catastrophizing and both pain severity and pain interference (Hanley, Raichle, Jensen, & Cardenas, 2008; Mun, Okun, & Karoly, 2014; Severeijns, Vlaeyven, van den Hout, & Weber, 2001). *Pain acceptance* refers to the extent to which individuals are willing

to stay with pain and engage in meaningful activities despite pain (McCracken, Vowles, & Eccleston, 2004). Higher pain acceptance is also a potent predictor of lower pain severity and pain interference (McCracken, 1998; McCracken & Vowles, 2008; C.J. Mun, Karoly, & Okun, 2015).

Only one study to date has examined the association between pain catastrophizing and pain severity and pain-related disability among MMT patients (Garnet et al., 2011). The present study sought to replicate the findings of this previous study, which is crucial especially in light of the replication crisis in psychology research (Shrout & Rodgers, 2018). We also further extended our previous findings by including both pain catastrophizing and pain acceptance in same models when examining their relations with pain severity and pain interference while controlling for a number of important covariates. Specifically, we controlled for sex (Fillingim, King, Ribeiro-Dasilva, Rahim-Williams, & Riley III, 2009), age (Molton & Terrill, 2014), race (Campbell, Edwards, & Fillingim, 2005), current methadone dose (Peles, Schreiber, Gordon, & Adelson, 2005), depressive and anxiety symptoms (Bair, Wu, Damush, Sutherland, & Kroenke, 2008; Banks & Kerns, 1996), and stress (Dufton et al., 2008), which are previously known to be associated with individuals' experience of pain severity and pain interference. We hypothesized that each of the two variables would be uniquely associated with pain severity and pain interference over and above these covariates.

Methods

Setting

The study was conducted at APT Foundation, a community-based not-for-profit organization headquartered in a mid-sized city in New England. The APT Foundation is unique among MMT programs since it provides eligible patients with OUD access to methadone on the same day as screening, irrespective of ability to pay, and patients are provided real-time access to a variety of group and individual counseling options from which they are free to choose. Groups included relapse prevention, stress reduction, and a variety of complementary and integrated health approaches (e.g., acupuncture, exercise). Individual sessions with counselors were also available on request.

Consistent with federal guidelines (Substance Abuse and Mental Health Services Administration, 2015), during the first 90 days of MMT, patients attend the clinic Monday-Saturday for daily methadone dispensing (and receive a take-home bottle for Sunday). Following 90 days, pending verification of abstinence from illicit substances and stability, patients are eligible to begin receiving additional take-home methadone bottles. Patients are expected to attend at least one counseling visit per month. While the APT Foundation operates a research-based clinic that offers treatment to patients on MMT with chronic pain, none of the participants recruited for this study had attended the pain clinic.

Participants

Participants were drawn from a larger study of 158 adults who were enrolled in MMT for OUD for at least one month at the APT Foundation. All prospective patients at APT

Foundation met with a master's level clinician who confirmed that patients met Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013) criteria. While many patients entering MMT exhibit non-medical use of prescription opioids, in order to be admitted onto MMT, they were required to meet DSM-5 criteria for OUD. For the purpose of the study, we excluded those (n = 25) who did not experience any physical pain in the past week. Only those who reported physical pain that lasted more than 3 months and those who reported at least some pain (at least 2 out of 10 in Numerical Rating Pain Scale) experienced "sometimes" during the previous 7 days (N = 133) were included in the analysis.

Procedures

The study, involving the use of survey data without identifiers, was approved by the non-profit organization Foundation Board and was presented to the Institutional Review Board at a local medical school that is affiliated with the organization, which exempted it from review. Participants were recruited between January 2014 and March 2015 by fliers posted at three different MMT clinics of the non-profit organization. Flyers indicated "Want to help us improve methadone treatment? Tell us about your experiences at APT Foundation!" To be eligible for the present study participants had to be currently receiving MMT at the clinic and English-speaking. Research assistants administered the questionnaire packet after describing the study. Participants were compensated $15 for their study participation.

Measures

Pain Severity—The Brief Pain Inventory (BPI; Cleeland and Ryan, 1994) was used to measure pain severity. It is based upon 0 to 10 Numerical Rating Scales. A composite of four items ("average," "worst," "least" pain past 7-days, and pain "right now") was created by taking the average. Previous studies demonstrated that these four items load well together on a single factor (Caraceni et al., 1996; Cleeland & Ryan, 1994; Ger, Ho, Sun, Wang, & Cleeland, 1999; Radbruch et al., 1999; Wang, Mendoza, Gao, & Cleeland, 1996). Cronbach's alpha was .78.

Pain Interference—Pain interference was also measured via the composite (mean) of five BPI items which assessed the extent to which patient experienced that pain interfered with their (1) general activity, (2) relationship with other people, (3) mood, (4) sleep, and (5) enjoyment of life past 7-days. Previous factor analyses found that these seven items indicating pain interference load together on a single factor (Caraceni et al., 1996; Cleeland & Ryan, 1994; Ger et al., 1999; Radbruch et al., 1999; Wang et al., 1996). Cronbach's alpha was .87.

Pain Catastrophizing—Pain catastrophizing was measured by using 13-item Pain Catastrophizing Scale (PCS; Sullivan et al., 1995). Each of the items is rated on a scale from 0 (not at all) to 4 (all the time) and assesses the extent to which participants tend to feel helpless, magnify, and ruminate about their pain experience. We used the total score with higher scores indicating greater pain catastrophizing. It is suggested that total PCS scores above 30 indicate clinically meaningful levels of pain catastrophizing (Sullivan et al., 1995). Cronbach's alpha was .93.

Pain Acceptance—The 20-item Chronic Pain Acceptance Questionnaire (CPAQ-20; McCracken et al., 2004) was used to measure the extent to which individuals are willing to engage in important daily activities despite experiencing pain while not trying to avoid or control their pain. Each of the items is rated on a scale from 0 (never true) to 5 (always true). We used the total score with higher scores indicating greater pain acceptance. Cronbach's alpha was .70.

Covariates

Sex.: Participants' sex was measured by self-report. The value 0 was coded as male and 1 was coded as female. There were no other categories (e.g., intersex, transgender) available for this measure.

Age.: Participants reported their age when filling out other survey questionnaires.

Race.: Participants were asked to report their race based upon categories including European White, Black, Native American, Asian American, and Others. As there were very small number of participants who indicated themselves other than White and Black (see Table 1), we collapsed all racial minority categories into one. Hence, when using the race as a covariate in main analyses, we coded 0 as European White and 1 as Minority.

Current Methadone Dose (mg/day).: Participants' response to the question "What is your current methadone dose?" was used to calculate current methadone dose (mg/day).

Depressive and anxiety symptoms.: Participants' depressive and anxiety symptoms were measured by the two subscales from the Brief Symptom Inventory-18 (Derogatis, 2001). The BSI-18 is a well-validated and widely used 18-item self-reported scale that measures psychological distress during the past 7-days (Derogatis, 2001; Durá et al., 2006; Franke et al., 2011). Using gender-specific norms from the scoring manual, summed subscale scores were transformed into *T*-scores. Cronbach's alphas for depression and anxiety subscales were .89 and .90, respectively.

Stress level.: Participants' stress level was assessed by the 10-item Perceived Stress Scale (PSS-10; Cohen, Kamarck, & Mermelstein, 1994). Using a 5-point Likert scale ranging from 0 (Never) to 4 (Very Often), the PSS-10 measures the extent to which current situations in life are thought to be stressful. Higher scores indicate greater perceived stress. Although different versions of PSS are available, PSS-10 has the best psychometric properties (Lee, 2012). Cronbach's alpha was .72.

Analytic plan

First, descriptive statistics including means, standard deviations, observed ranges, proportions of missingness and bi-variate correlations among all study variables were conducted. Second, hierarchical multiple regression analyses were conducted. Specifically, the Step 1 model includes only covariates, and the Step 2 model includes independent variables in addition to covariates. This method allows for examining how much additional variance is explained by adding independent variables after accounting for all covariates.

Cohen's f^2 (Cohen, 1992) was used to measure effect size. f^2 values near .02 are defined as small, .15 as medium, and .35 as large effect. In regard to missing data, we only had missing data on the race variable (shown in Table 2). Six out of 133 (4.5%) participants did not provide any information on their race. To determine whether the missing data meet the missing completely at random (MCAR) assumption, we conducted the Little's MCAR test by including all study variables. The result showed that our missing data met the MCAR assumption, $\chi^2(10) = 10.78$, $p = .38$. Since missing data were few and met the MCAR assumption, listwise deletion was used for handling missing data. SPSS Version 26 was used for data analyses.

Results

Participant characteristics

On average, participants were enrolled in MMT for more than 3 years ($M = 42.1$ months, $SD = 56.2$), and were predominantly middle aged ($M = 43.9$, $SD = 10.6$), Caucasian (61.4%), and male (60.2%). Approximately one third of the sample (31.5%) was African-American. A large proportion of participants had at least a high school level of education (69.6%), were never married (51.9%), and unemployed (60.9%). More than half of the participants (63.2%) reported having chronic pain (pain experience lasting more than three months) and on average participants reported experiencing the current episode of physical pain for the past 43.3 months ($SD = 67.2$). More detailed demographic information is presented in Table 1.

Preliminary analyses

The mean pain catastrophizing level was quite close to clinically meaningful level (Sullivan et al., 1995). Participants' mean level of pain acceptance was similar to that of patients with chronic pain conditions without OUD (Costa & Pinto-Gouveia, 2011; Wetherell et al., 2011). Age and race were significantly associated with pain severity. Specifically, participants who were older and non-White were more likely to report pain severity. Participants' sex (0 = male, 1 = female), perceived stress, and depressive and anxiety symptoms were positively and significantly associated with pain interference. Pain catastrophizing and pain acceptance were quite strongly correlated ($r = -.60$).[1]

Results of hierarchical multiple regression

Pain Severity as a Dependent Variable—Table 2 provides detailed regression parameter estimates of the model with pain severity as a dependent variable. In step 1, only age ($B = .05$, $SE = .02$, $p < .05$) was significantly associated with pain severity. All of the covariates explained 12% of variance ($R^2 = 0.12$), and the overall model was statistically significant, $F(7, 119) = 2.41$, $p < .05$. In step 2, the model included pain catastrophizing and pain acceptance in addition to covariates. Results showed that individuals with higher pain catastrophizing ($B = .04$, $SE = .01$, $p < .05$) and lower pain acceptance ($B = -.03$, $SE = .01$, $p < .05$) reported higher pain severity while controlling for all other covariates. By adding

[1]We examined potential multi-collinearity among independent variables and covariates using variance inflation factor (VIF). The highest VIF score across regression models was 3.33 and this was far below the VIF cutoff score of 10 (Hair, Anderson, Tatham, & Black, 1995).

these two variables, an additional 14% of the variance was explained (R^2 = .27) and the model was statistically significant, $F(9, 117) = 4.68$, $p < .001$. Cohen's f^2 was .37 indicating a large effect size.

Pain Interference as a Dependent Variable—Table 3 provides detailed regression parameter estimates of the model with pain interference as a dependent variable. In step 1, we found that individuals who were older ($B = .05$, $SE = .02$, $p < .05$), female ($B = 1.31$, $SE = .42$, $p < .01$), and endorsed higher anxiety symptoms ($B = .06$, $SE = .03$, $p < .05$) were more likely to report greater pain interference. Covariates explained 26% of variance ($R^2 = .26$), and the overall model was statistically significant, $F(7, 117) = 5.89$, $p < .001$. Results of the step 2 model showed that both independent variables were significantly associated with pain interference while controlling for covariates. Specifically, individuals with higher pain catastrophizing ($B = .07$, $SE = .01$, $p < .001$) and lower pain acceptance ($B = -.05$, $SE = .01$, $p < .01$) reported higher pain interference. By adding these two variables, an additional 29% of the variance was explained ($R^2 = .55$), and the overall model was statistically significant, $F(9, 117) = 15.58$, $p < .001$. Cohen's f^2 was 1.22 indicating a large effect size.

Findings of post-hoc sensitivity analyses

We conducted a post-hoc sensitivity analysis by including only participants with chronic pain. Similar patterns of main findings emerged on these participants: while controlling for covariates (1) pain catastrophizing ($B = .03$, $SE = .02$, $p < .05$) and pain acceptance ($B = -.03$, $SE = .01$, $p < .05$) were significantly associated with pain severity; and (2) pain catastrophizing ($B = .04$, $SE = .02$, $p < .05$) and pain acceptance ($B = -.07$, $SE = .02$, $p < .001$) were significantly related to pain interference.

Pain severity is considered a major precursor of pain interference (Krebs, Carey, & Weinberger, 2007; Rudy, Kerns, & Turk, 1988). In order to test robustness of the associations among pain catastrophizing, pain acceptance, and pain interference, in the post-hoc analysis, we included pain severity as an additional covariate in the model. Even when controlling for pain severity and all other covariates (sex, age, race, methadone dose, depression, anxiety, and stress), both pain catastrophizing ($B = .06$, $SE = .01$, $p < .001$) and pain acceptance ($B = -.04$, $SE = .01$, $p < .01$) were significantly associated with pain interference.

Discussion

A large proportion of MMT patients have chronic pain and pain can substantially interfere with optimal OUD treatment processes (e.g., higher risk for illicit drug use problems and treatment non-adherence). However, chronic pain is often untreated in this clinical setting because most of the providers do not have expertise in managing both OUD and chronic pain, and there is a paucity of evidence-based pain interventions that target MMT patients. There are a number of pain interventions that garnered scientific support for improving pain and functioning among individuals with chronic pain without a co-morbid substance use disorder (e.g., Ehde et al., 2014; Veehof et al., 2011). However, given the different clinical profiles of patients with chronic pain alone compared to those with both chronic pain and

OUD (Barry et al., 2016), the extent to whether psychosocial pain interventions developed for patients with chronic pain only are effective for those with both chronic conditions (chronic pain + OUD) is an open question. Hence, evaluating efficacy of these existing psychosocial pain interventions for individuals who have concurrent OUD and chronic pain in MMT settings is important. Prior to these intervention studies, however, a logical first step is to examine whether pain catastrophizing and pain acceptance, which are two important targets of psychosocial treatments for chronic pain, are significantly associated with core pain-related variables among MMT patients.

The present study successfully replicated the findings from a previous study of pain catastrophizing among MMT patients. Garnet et al. (2011) examined whether a number of pain coping strategies such as catastrophizing, praying, diverting attention, and re-interpreting pain sensations are associated with pain severity and pain-related disability among 108 patients with MMT who also reported pain. The authors found that while controlling for covariates, only pain catastrophizing was related to pain severity and pain-related disability (Garnet et al., 2011). In our study, we also found that pain catastrophizing was significantly associated with both pain severity and pain interference over and above pain acceptance and a number of important covariates. It is particularly notable that the finding on pain catastrophizing was replicated even when using different pain catastrophizing measures. Garnet et al. (2011) used the pain catastrophizing subscale from the Coping Strategies Questionnaire-Revised (Riley & Robinson, 1997), whereas the present study used the Pain Catastrophizing Scale. Thus, our findings provide further support that pain catastrophizing is a potentially important clinical target for MMT patients who have co-occurring chronic pain.

Consistent with previous literature that is based upon chronic pain patients without OUD (Hanley et al., 2008; C.J. Mun et al., 2015; Severeijns et al., 2001; Vowles, McCracken, McLeod, & Eccleston, 2008), both pain catastrophizing and pain acceptance were robustly related to pain severity and interference while controlling for a number of confounding variables. It is noteworthy that inclusion of pain catastrophizing and pain acceptance explained additional 14% and 29% of the variance in pain severity and pain interference, respectively. Effect sizes of our regression models were also large. Furthermore, it is notable that when we conducted the post-hoc analysis that included pain severity along with all other covariates, both pain catastrophizing and pain acceptance were still significantly associated with pain interference. This suggests that over and above the severity of pain, pain catastrophizing and pain acceptance may play a unique role in individuals' engagement in and performance of daily functioning, which is an important indicator of psychosocial well-being (Mun et al., 2019).

Our preliminary findings provide some potential that modulation of pain catastrophizing and pain acceptance may significantly decrease the burden of pain-related experiences among MMT patients. Conducting a longitudinal study, such as examining whether pain catastrophizing and pain acceptance predict changes in pain severity and pain interference over time among MMT patients, is a critical next step in supporting the idea of targeting pain catastrophizing and pain acceptance as pain intervention strategies for MMT patients.

Given the limited access to pain experts in the community among MMT patients, onsite integrated treatments that address OUD and chronic pain are needed. A recent study demonstrated the feasibility, acceptability, and preliminary efficacy of 12 sessions of CBT designed for MMT patients with chronic pain and OUD in a methadone clinic (Barry et al., 2019). Briefer psychosocial interventions that target pain catastrophizing and pain acceptance should also be considered. For instance, a single-session intervention that focuses on reducing pain catastrophizing has been recently developed and showed some promising initial results (Darnall, Sturgeon, Kao, Hah, & Mackey, 2014). Studies also demonstrate the potential utility of implementing a brief 4-session ACT group delivered in a primary care setting (McCracken, Sato, & Taylor, 2013).

It is also important to understand that both MMT patients and providers are interested in pain management. For instance, Barry and his colleagues (2014) demonstrated the feasibility and acceptability of implementing single session cognitive-behavioral therapy and mindfulness-based groups for pain management among 349 MMT patients. Patients reported high satisfaction in attending these groups, and engagement with these groups was associated with lower pain and depressive symptoms (Barry et al., 2014). In addition, qualitative studies suggest that methadone treatment counselors are highly interested in receiving training for pain management and they also believe that psychosocial pain management will be efficacious for MMT patients with chronic pain (Barry et al., 2008; Oberleitner et al., 2016). These previous studies further suggest the need of developing a pain intervention that is accessible and scalable for MMT patients and providers.

It has been demonstrated that similar to the MMT patient population, a large proportion of OUD patients with other medication-assisted treatments (e.g., buprenorphine, naloxone) also report chronic pain (Barry et al., 2013; Mark, Dilonardo, Vandivort, & Miller, 2013; Stein et al., 2015). However, the extent to which findings from our study are generalizable to patients with OUD who receive other forms of medication-assisted treatment is currently unclear. Hence, studies that replicate and extend our findings need to be conducted in other OUD samples with different medication-assisted treatments. This effort may help develop and implement psychosocial pain interventions that can be used in various settings with patient populations who have both OUD and pain problems.

Although it was beyond the scope of the present study, it is important to note that individuals on MMT not only have high prevalence of co-occurring chronic pain but also high psychiatric co-morbidity (Beitel et al., 2017; Fei, Yee, & Habil, 2015; Rosic et al., 2017). Stepped care approach (Bower & Gilbody, 2005) might be potentially useful in clinical settings so that MMT patients with tri-morbidity (OUD + chronic pain + other psychiatric condition) receive more resource-intensive treatment from providers. Evidence-based research on treating these tri-morbidity in MMT setting should also be considered. For instance, although there are numerous empirical evidence that interventions such as CBT, mindfulness, and ACT can target a wide range of mental health and chronic physical health issues independently (A-tjak et al., 2015; Hofmann, Asnaani, Vonk, Sawyer, & Fang, 2012; Khoury et al., 2013), to our knowledge, none of the previous studies explored the utility of these interventions in treating tri-morbidity.

Limitations

The present study has a number of limitations. First, our findings are based upon cross-sectional data, and thus, causal inference cannot be drawn. However, consistency of our findings with previous longitudinal studies on pain catastrophizing and pain acceptance further strengthens our theoretical argument. Second, the sample of this study is from one specific MMT treatment organization within a particular geographical region. Hence, our findings may not be generalizable to other MMT clinics. Third, our study did not measure concurrent use of substances (e.g., tobacco, alcohol, and cannabis), which may have been significantly associated with patients' pain severity and pain interference. Although a master's level clinician collected both urine samples and self-report data about both licit and illicit substance use prior to beginning MMT, data collected during the admissions process were not available to the researchers. Fourth, it is unclear in the present study whether order of onset of OUD and chronic pains affected the associations among pain catastrophizing, pain acceptance, and pain-related variables. For instance, it is possible that those individuals who developed OUD because of pain issues may show greater association between pain catastrophizing and pain-related variables. Future research would benefit from clarifying the possible moderating role of the order of condition onset. Fourth, our sample only includes MMT patients who were interested in participating in the study. It is not clear whether characteristics of the current sample significantly differ from the rest of MMT patients who did not participate in the study. Fifth, due to low number of participants in racial categories other than White and Black, we collapsed all participants of color into one category. Future studies should recruit more diverse sample of participants. Lastly, in the present study, the option for participants to indicate sex/gender was only available for male and female. Future studies should consider measuring other sex/gender options such as intersex and transgender.

Conclusion

Dealing with pain is a significant barrier for ongoing MMT as evidenced by lower treatment adherence and higher prevalence of illicit drug use. Hence, helping patients effectively manage their pain is important. Consistent with previous findings that are based upon non-OUD chronic pain patients, both pain catastrophizing and pain acceptance were significantly associated with pain severity and pain interference while controlling for demographics, emotional distress, and methadone dose. More attention is required on testing whether psychosocial pain interventions are efficacious for MMT patients with co-occurring chronic pain. Our findings highlight that both pain catastrophizing and pain acceptance could be promising pain intervention targets among MMT patients.

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Table 1.

Socio-demographics of the whole sample and chronic pain only sample

	Mean or % (SD)	
Variables	**Whole Sample (*N* = 133)**	**Chronic Pain Only Sample (*N* = 84)**
Age (years)	43.89 (10.61)	45.55 (9.99)
Gender		
Male	60.2%	63.1%
Female	39.8%	36.9%
Education		
Less than high school	26.3%	29.8%
Completed high school	45.1%	38.1%
Some college	14.3%	14.3%
Associate/Bachelor's degree	6.1%	7.2%
Vocational Training	8.3%	10.8%
Marital Status		
Never married	51.9%	51.2%
Married/partnered	18.8%	20.3%
Widowed	5.3%	6.0%
Divorced	20.3%	19.0%
Separated	3.8%	3.6%
Employment		
Part- or Full-time	6.8%	6.0%
Self-employed	3.0%	3.6%
Unemployed	60.9%	56.0%
Retired	3.8%	3.6%
Disabled	24.8%	29.8%
Student	0.8%	1.2%
Race		
Caucasian	61.4%	55.7%
Black/African American	31.5%	32.9%
Asian/Pacific Islander	0.8%	1.3%
Native American/Alaskan	0.8%	1.3%
Other	5.5%	8.9%
Ethnicity		
Hispanic	12.0%	14.3%
Non-Hispanic	88.0%	85.7%

Table 2.

Descriptive statistics and bi-variate correlations of study variables from the whole sample (N = 133)

Variables	1	2	3	4	5	6	7	8	9	10	11
1. Pain Severity	–	.49**	.39**	−.36**	.29**	−.01	−.24**	−.01	−.03	.02	−.02
2. Pain Interference		–	.66**	−.60**	.08	.18*	−.06	.27**	.31**	.34**	−.05
3. Pain Catastrophizing			–	−.60**	.08	.01	−.14	.24**	.38**	.41**	−.02
4. Pain Acceptance				–	−.08	−.01	.01	−.15	−.34**	−.32**	.06
5. Age					–	−.20*	−.44**	−.34**	−.31**	−.34**	.01
6. Sex (0 = Male, 1 = Female)						–	.12	.16	−.10	.03	.17
7. Race (0 = Minority, 1 = White)							–	.20*	.29**	.31**	.09
8. Stress								–	.64**	.65**	−.16
9. Depression									–	.80**	−.10
10. Anxiety										–	−.06
11. Methadone Dose (mg/day)											–
Mean	4.94	5.16	27.16	56.30	43.89	1.40	0.61	21.80	58.78	59.83	82.60
SD	1.87	2.39	13.74	14.36	10.61	0.49	0.49	5.41	11.06	11.84	29.78
Minimum	0.50	0.00	2.00	19.00	18.00	1.00	0.00	8.00	40.00	38.00	23.00
Maximum	9.25	10.00	52.00	91.00	69.00	2.00	1.00	36.00	81.00	81.00	145.00
Missing %	0%	0%	0%	0%	0%	0%	4.5%	0%	0%	0%	0%

Note.

* $p < .05$,

** $p < .01$

Table 3.

Multiple regression analysis of predictor of pain severity (whole sample; N = 133)

Step	Predictors	*B*	SE	Standardized *β*	t	*p*	R^2	R^2 Change
1	Intercept	1.73	1.66		1.04	.30	.13	
	Age	.05*	.02	.26	2.61	< .05		
	Sex	.16	.37	.04	0.44	.66		
	Race	−.68	.38	−.18	−1.80	.07		
	Stress	.01	.04	.03	.28	.78		
	Depressive symptoms	−.02	.03	−.10	−.65	.51		
	Anxiety Symptoms	.03	.02	.21	1.41	.16		
	Methadone Dose	.00	.01	.01	.14	.89		
2	Intercept	5.95***	2.02		2.95	< .001	.27	.14
	Age	.03	.02	.16	1.73	.09		
	Sex	−.03	.34	−.01	−.08	.94		
	Race	−.37	.36	−.10	−1.03	.30		
	Stress	.03	.04	.08	.71	.48		
	Depressive symptoms	−.04	.03	−.24	−1.68	.10		
	Anxiety Symptoms	.01	.02	.05	.37	.71		
	Methadone Dose	.00	.01	.01	.13	.90		
	Pain Catastrophizing	.04*	.01	.26	2.42	< .05		
	Pain Acceptance	−.03*	.01	−.23	−2.29	< .05		

Note.

* $p < .05$,

** $p < .01$,

*** $p < .01$

Table 4.

Multiple regression analysis of predictor of pain interference (whole sample; N = 133)

Step	Predictors	*B*	SE	Standardized *β*	t	*p*	R^2	R^2 Change
1	Intercept	−5.13**	1.91		−2.68	< .01	.26	
	Age	.05**	.02	.24	2.63	< .01		
	Sex	1.31***	.42	.27	3.10	< .001		
	Race	−.66	.44	−.14	−1.51	.13		
	Stress	.01	.05	.02	.19	.85		
	Depressive symptoms	.05	.03	.21	1.49	.14		
	Anxiety Symptoms	.06*	.03	.30	2.23	< .05		
	Methadone Dose	.00	.01	−.02	−.23	.82		
2	Intercept	1.79	1.99		.90	.37	.55	.29
	Age	.02	.02	.10	1.39	.17		
	Sex	.98***	.34	.20	2.91	< .001		
	Race	−.07	.36	−.01	−.19	.85		
	Stress	.04	.04	.09	.93	.35		
	Depressive symptoms	.00	.02	.01	.09	.93		
	Anxiety Symptoms	.02	.02	.07	.68	.50		
	Methadone Dose	.00	.01	−.02	−.36	.72		
	Pain Catastrophizing	.07***	.01	.42	4.97	< .001		
	Pain Acceptance	−.05**	.01	−.29	−3.58	< .01		

Note.

* $p < .05$,

** $p < .01$,

*** $p < .01$