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## Pain-Related Anxiety among Adults with Obesity and Chronic Pain: Relations with Pain, Opioid Misuse, and Mental Health

Andrew H. Rogers, M.A.<sup>1</sup>, Brooke Y. Kauffman, M.A.<sup>1</sup>, Lorra Garey, Ph.D.<sup>1</sup>, Gordon J.G. Asmundson, Ph.D.<sup>2</sup>, Michael J. Zvolensky, Ph.D.<sup>1,3,4</sup>

<sup>1</sup>Department of Psychology, University of Houston

<sup>2</sup>Department of Psychology, University of Regina

<sup>3</sup>Department of Behavioral Science, The University of Texas MD Anderson Cancer Center

<sup>4</sup>HEALTH Institute, University of Houston

### Abstract

Obesity affect a significant proportion of the population in the United States, and is associated with numerous health consequences including anxiety, depression, and chronic pain. Additionally, pain among adults with obesity has been associated with greater mental health problems and substance use problems. Yet little work has examined psychological vulnerability factors associated with these relations, and pain-related anxiety may be one candidate psychological correlate of these relations. Therefore, the current study examined the association of pain-related anxiety with pain intensity, disability, opioid misuse, anxiety, and depression among 164 adults (81.7% female,  $M_{age} = 40.13$  years,  $SD = 10.85$ ) with obesity ( $M_{BMF} = 37.21$ ,  $SD = 6.70$ ) and chronic pain. Results suggested that pain-related anxiety was significantly associated with all outcomes, and these results suggest that pain-related anxiety may play an important role in physical health, mental health, and substance use outcomes among adults with obesity and chronic pain.

### Keywords

Obesity; Chronic Pain; Pain-related Anxiety; Mental Health; Substance Use

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It is estimated that obesity affects approximately 40% of adults in the Unites States <sup>1</sup>. The direct medical expenditures for obesity-related medical problems exceeds \$51 billion per year <sup>2</sup>, with an additional 55–60% of indirect costs associated with lost productivity <sup>3</sup>. Obesity is also associated with a host of negative consequences, including increased medical morbidity and mortality, mental health problems, and bodily pain <sup>4</sup>. For example, mental health problems, including anxiety and depression, are commonly reported among individuals with obesity, with longitudinal research suggesting that obesity may increase risk for later depression <sup>5</sup>. Further, the majority of individuals with obesity report comorbid

medical problems, including (but not limited to) hypertension, high cholesterol, diabetes, heart disease, and stroke <sup>6</sup>.

The experience of acute and chronic pain is among the most clinically significant problems experienced by individuals with obesity, with clinically significant pain being reported at three times the rate of the general population <sup>7</sup>. Obesity has been hypothesized as a risk factor for the onset of clinically significant pain which, in turn, has been found to be associated with several deleterious outcomes (e.g., depression, sedentary behavior, disability; McVinnie, 2013). Additionally, evidence has shown an increased likelihood of opioid use and misuse among individuals with obesity <sup>9</sup>. At the neurobiological level, obesity is thought to cause pain through a number of different mechanisms, including inflammation and hormone imbalance<sup>10</sup>. One cross-sectional study found that obesity was associated with pain over and above the variance accounted for by inflammation or other metabolic syndromes <sup>11</sup>, and another found that obesity was associated with changes in pain processing<sup>12</sup>. The relationship between obesity and pain has been conceptualized as a bi-directional positive reinforcing loop, whereby obesity increases pain experience which, in turn, is associated with greater obesity due to sedentary behavior and increased eating when sedentary <sup>10</sup>.

Despite research establishing a relationship between obesity, pain, and related clinical correlates (e.g., opioid misuse), little work has examined individual difference psychological constructs that may be associated with elevated pain-related complaints, opioid misuse, and poorer mental health among individuals with obesity and co-occurring chronic pain. This limitation is unfortunate given the considerable overlap between obesity and pain. Psychological constructs have been found to be uniquely associated with both obesity <sup>13,14</sup> and pain experience <sup>15,16</sup>, suggesting there may be constructs specific to adults with obesity contributing to the pain experience. The increased inflammation that is often observed accompanying obesity may be directly linked to anxiety, as past work suggests a link between inflammation and anxiety-like states (i.e. anxiety symptoms and disorders)<sup>17</sup>, and work among adults suggested that compared to those without obesity, those with obesity had fewer structural brain connections and were more likely to report anxiety and depressive symptoms<sup>18</sup>. Additionally, the endogenous opioid system has been associated regulation of eating, mood, and pain, such that, compared to healthy control subjects, adults with obesity showed greater pain sensitivity a greater biological tendency towards anxiety<sup>19</sup> and pain states<sup>20</sup>.

Pain-related anxiety, reflecting worry about pain and the negative consequences of pain <sup>21</sup>, may be one psychological construct more strongly associated with pain experience, mental health, and opioid misuse among individuals with obesity than health weight adults, and may be particularly relevant to adults with obesity given the high rates of observed systemic inflammation and tendency towards anxiety<sup>11</sup>. Taken together, it is plausible that adults with obesity and chronic pain may show a greater tendency towards pain-related anxiety than healthy weight adults, making it an ideal candidate vulnerability factor for this at-risk population. Although little work has examined the impact of pain-related anxiety on pain, mental health, and opioid outcomes among individuals with obesity, research among healthy weight individuals with chronic pain has found that pain-related anxiety is associated with

greater pain intensity and disability<sup>22,23</sup>, opioid misuse<sup>24,25</sup>, and anxiety and depressive symptoms<sup>26</sup>. Given that neurobiological differences may be associated with anxiety for adults with obesity<sup>18</sup>, it is possible that the associations between pain-related anxiety and outcomes may be stronger than those observed for healthy weight adults. It is also important to consider the potential bi-directional nature of these relations, and consider the findings in light of this.

Past work among healthy weight adults suggests significant associations between pain-related anxiety and pain experience, opioid misuse, and anxiety and depression<sup>25,27</sup>. Given that obesity-specific features may be associated with an increased tendency toward anxiety-like states, including pain-related anxiety, it is possible that these relations would be observed among adults with obesity. The current study examined the association of pain-related anxiety with several clinically relevant constructs—pain intensity, pain-related disability, current opioid misuse, severity of opioid dependence, anxiety, and depression—among adults with obesity and chronic pain. It was hypothesized that pain-related anxiety would be positively associated with each of the criterion variables, and these associations would be evident above the variance accounted for by theoretically relevant covariates, including age<sup>28</sup>, sex<sup>29</sup>, and BMI<sup>30</sup>. By better understanding these outcomes, it may be plausible to inform intervention and prevention efforts to reduce negative health outcomes among adults with obesity.

## Method

### Participants

Participants were 164 adults (81.7% female,  $M_{age} = 40.13$  years,  $SD = 10.85$ ) with obesity ( $M_{BMI} = 37.21$ ,  $SD = 6.70$ ) who reported current chronic pain and opioid use. The current study represents a secondary data analysis from a larger project on chronic pain and mental health. Participants for the parent study were included in the present study if they (1) were between the ages of 18 and 64, (2) reported chronic pain (defined as persistent, chronic pain lasting for at least 3 months in duration), (3) reported current moderate to severe pain over the previous four weeks and (4) reported current use of opioid pain medication. For the current study, a subset of the sample with a BMI  $> 30$ <sup>31</sup> was selected. Participants were excluded from the current study for non-fluency in English (to ensure comprehension of study materials – sample was restricted to the United States and the survey program ensured English proficiency prior to sending participants a survey link) and inability to provide informed, voluntary, written consent to participate. For participant descriptive data please see Table 1.

### Measures

**Demographics Questionnaire.**—Demographic information was collected from participants including age, sex, race/ethnicity, level of education, and job status to describe the current sample. Age and sex were utilized as covariates in the current study.

**Body Mass Index (BMI).**—BMI for each participant was calculated per World Health Organization recommendations utilizing participant self-reported height and weight

measurements ( $[\text{weight (pounds)}]/[\text{height (inches)}^2 \times 703]$ )<sup>32</sup>. BMI was utilized as a study covariate.

**Pain-related Anxiety.**—The Pain Anxiety Symptoms Scale-20 (PASS-20)<sup>33</sup> is a 20-item self-report measure of fear and anxiety related to pain. Participants are asked to rate on a 6-point Likert-type scale the degree to which they experience fear and anxiety specifically related to pain. Items are rated from 0 (*never*) to 5 (*always*) and summed to create a total score (*possible range 0–200*). The PASS-20 is a reliable and valid measure of pain-related anxiety<sup>21,33</sup>. Although past work suggests that a 4-factor solution of the PASS-20<sup>34</sup>, a recent psychometric evaluation supported a hierarchical factor structure, thereby suggesting the use of the total score is the most parsimonious approach<sup>35</sup>. The PASS-20 demonstrated excellent internal consistency (Cronbach's  $\alpha = .97$ ) and was utilized as a predictor variable in the current study.

**Pain Intensity and Disability**—The Graded Chronic Pain Scale (GCPS)<sup>36,37</sup> is an 8-item self-report measure of pain intensity and disability. Participants are asked to indicate how they would rate their pain right now, worst pain in the past three months, and average pain during the past three months to create a pain intensity subscale (*possible range 0–30*). Participants are also asked 4-items representative of interference related to pain to create a pain disability subscale score (*possible range 0–40*). The GCPS has exhibited acceptable psychometric properties<sup>37</sup>. In the current study, pain intensity (Cronbach's  $\alpha = 0.85$ ) and disability (Cronbach's  $\alpha = 0.89$ ) were used as criterion variables.

**Current Opioid Misuse.**—The Current Opioid Misuse Measure (COMM)<sup>38</sup> is a 17-item questionnaire used to screen for individuals who are exhibiting behaviors of opioid misuse while undergoing opioid therapy. Participants are asked to rate on a 5-point scale from 0 (*never*) to 4 (*very often*) the occurrence of several behavioral concerns. Items are summed to create a continuous score (*possible range 0–68*). The current measure has demonstrated test-retest reliability as well as construct validity<sup>38</sup>. The COMM total score was utilized in the current study as a criterion variable (Cronbach's  $\alpha = .96$ ).

**Opioid Dependence Severity.**—The Severity of Dependence Scale (SDS)<sup>39</sup> is a 5-item measure of severity of dependence to substances that has been validated for opioid use. Participants are asked to indicate behavioral patterns of their substance use on a 4-point Likert-type scale from 0 (*never*) to 3 (*always*). Items are summed to create a total score (*possible range 0–15*). The SDS has demonstrated good psychometric properties in previous work<sup>39</sup>. The SDS total score was utilized as a criterion variable in the current study (Cronbach's  $\alpha = .86$ ).

**Anxiety and Depressive Symptoms.**—The Patient Health Questionnaire-4 (PHQ-4)<sup>40</sup> is a brief self-report measure of anxiety (2-items) and depressive (2-items) symptoms. Participants are asked to rate the extent to which they experienced anxiety and/or depressive symptoms over the past 2-weeks. Items are rated on a 4-point Likert-type scale from 0 (*not at all*) to 3 (*nearly every day*) and summed to create an anxiety subscale (*possible range 0–6*) and depression subscale (*possible range 0–6*). In previous work, the PHQ-4 has demonstrated reliability and validity<sup>40</sup>. In the current study, the PHQ-4 anxiety subscale

(Cronbach's  $\alpha = .90$ ) and the PHQ-4 depression subscale (Cronbach's  $\alpha = .87$ ) were used as criterion variables.

## Procedure

Participants were recruited through an online survey management system (Qualtrics), which has been successfully implemented in past work<sup>41</sup>. Individuals with access to a Qualtrics Panels account who endorsed moderate to severe chronic pain and current use of opioid medication were provided the opportunity to complete an initial eligibility screening. If participants met eligibility criteria based on the screening, they were then re-directed to complete an anonymous Qualtrics survey. All participants provided informed consent. Participants were compensated for completing the survey in a variety of ways dependent on preference (e.g., gift cards, reward miles, reward points). The level of compensation across respondents for completing the survey remained consistent and equated to approximately \$4.20 per response. Qualtrics automatically incorporates a quality assurance check—measured as one-half the median soft launch time—which will automatically terminate those who are not responding thoughtfully. The study protocol was approved by the Institutional Review Board where the study took place.

## Analytic Strategy

Analysis were conducted using SPSS version 25. Sample descriptive statistics and zero-order correlations among study variables were examined. Six separate 2-step hierarchical regressions were then conducted to test the incremental predictive power of pain-related anxiety for six continuous criterion variables: (1) pain intensity, (2) pain disability, (3) current opioid misuse, (4) opioid dependence severity, (5) anxiety symptoms, and (6) depressive symptoms. For all analysis, step 1 included covariates (age, sex, and BMI), and step 2 included pain-related anxiety. Model fit for each of the steps was evaluated with the  $F$  statistic and increase in variance accounted for (change in  $R^2$ ) and squared semi-partial correlations ( $sr^2$ ) were used as measures of effect size for each of the individual predictors. All variables met assumptions of linear regression, including multivariate normal distribution of residuals and homoscedasticity. A Bonferroni correction was used to correct for multiple tests, indicating a  $p$  value of  $(.05/6) < .008$  required for significance.

## Results

### Descriptive Statistics

Correlations among all study variables are presented in Table 2. Pain-related anxiety was positively associated with each of the criterion variables (i.e., pain intensity, pain disability, current opioid misuse, opioid dependence severity, anxiety symptoms, depressive symptoms) and negatively associated with age.

### Hierarchical Regression Analysis

For pain intensity, step 1 of the model including covariates only was not statistically significantly different from zero ( $R^2 = .03$ ,  $F(3, 160) = 1.55$ ,  $p = .203$ ). In step 2, where pain-related anxiety was added, the model accounted for statistically significantly more variance in pain intensity ( $R^2 = .22$ ,  $R^2 = .20$ ,  $F(4, 159) = 11.46$ ,  $p < .001$ ); age and

BMI were positive predictors of pain intensity, and pain-related anxiety was a statistically significant predictor of pain intensity (see Table 3).

In predicting pain disability, step 1 of the model including covariates only was not statistically significantly different from zero ( $R^2 = .02$ ,  $F(3, 160) = 1.53$ ,  $p = .208$ ). In step 2, where pain-related anxiety was added, the model accounted for a statistically significant increase in variance ( $R^2 = .14$ ,  $R^2 = .12$ ,  $F(4, 159) = 6.64$ ,  $p < .001$ ); pain-related anxiety was a statistically significant predictor of pain disability (see Table 3).

For current opioid misuse, step 1 of the model with covariates only was statistically significantly different from zero ( $R^2 = .13$ ,  $F(3, 160) = 8.10$ ,  $p < .001$ ). Examining the individual predictors indicated that age and sex were statistically significant predictors of current opioid misuse. Pain-related anxiety was added in step 2 and the model remained statistically significant ( $R^2 = .39$ ,  $F(4, 159) = 25.39$ ,  $p < .001$ ) and accounted for a statistically significant increase in variance ( $R^2 = .26$ ,  $p < .001$ ). Age, sex, and pain-related anxiety were statistically significant predictors of current opioid misuse in step 2, such that increased age was associated with less misuse and male gender was associated with misuse (see Table 3).

In terms of opioid dependence severity, step 1 of the model including covariates only was statistically significantly different from zero ( $R^2 = .10$ ,  $F(3, 160) = 5.92$ ,  $p = .001$ ), with age and sex being statistically significant predictors of opioid dependence severity. In step 2, where pain-related anxiety was added, the model remained statistically significantly different from zero ( $R^2 = .28$ ,  $F(4, 159) = 15.16$ ,  $p < .001$ ) and accounted for a statistically significant increase in variance ( $R^2 = .18$ ,  $p < .001$ ); sex (male gender associated with greater dependence) and pain-related anxiety were statistically significant predictors of opioid dependence severity (see Table 3).

For anxiety symptoms, step 1 of the model including covariates only was not statistically significantly different from zero ( $R^2 = .05$ ,  $F(3, 160) = 2.71$ ,  $p = .047$ ). With the addition of pain-related anxiety in step 2 of the model, the model remained statistically significantly different from zero ( $R^2 = .25$ ,  $F(4, 159) = 13.40$ ,  $p < .001$ ) and accounted for a statistically significant increase in variance ( $R^2 = .20$ ,  $p < .001$ ); sex and pain-related anxiety were statistically significant predictors of anxiety symptoms (see Table 3).

Finally, in predicting depressive symptoms, step 1 of the model was not statistically significantly different from zero ( $R^2 = .05$ ,  $F(3, 160) = 2.83$ ,  $p = .04$ ). In step 2, where pain-related anxiety was added, the model remained statistically significantly different from zero ( $R^2 = .28$ ,  $F(4, 159) = 15.63$ ,  $p < .001$ ) and accounted for a statistically significant increase in variance ( $R^2 = .23$ ,  $p < .001$ ); sex and pain-related anxiety were statistically significant predictors of depressive symptoms (see Table 3).

## Discussion

Pain is commonly reported among adults with obesity<sup>7</sup> and is associated with mental health and substance use problems<sup>8</sup>. The current study examined pain-related anxiety as a potential psychological correlate for exacerbated pain intensity and disability, opioid misuse



and dependence, and anxiety and depressive symptoms. Results from the current study provide initial empirical support for pain-related anxiety as a unique correlate and *potential* risk factor for these conditions, whereby increased pain-related anxiety is associated with greater pain intensity, disability, opioid misuse, severity of opioid dependence, anxiety, and depressive symptoms. These findings were observed above variance accounted for by sex, age, and BMI. These results provide support for a theoretical model whereby pain-related anxiety may exacerbate pain experience and related physical and mental health outcomes among those with obesity; this perspective should be confirmed in future work. Future work should examine how and why pain-related anxiety may be associated with these outcomes among individuals with obesity.

Given the cross-sectional nature of the findings, it is important for future research to corroborate and extend the reported findings in meaningful ways. First, replication of the tested models in an independent dataset will serve to provide initial confirmatory evidence of the presented findings. Second, experimental studies may be able to examine the direct impact of pain-related anxiety on these outcomes. Recent experimental work has shown that inducing pain-related anxiety in the lab is possible and is associated with increased self-reported pain-related anxiety<sup>42</sup>. It would then be possible to causally examine how pain-related anxiety would be associated with pain experience (objective pain testing, e.g. cold pressor task), measures of substance use craving and withdrawal, and anxiety states (e.g. stress induction). Third, it would be important to examine these associations within person, over time. Previous work suggests a possible bi-directional relationship between obesity and pain-related outcomes<sup>10</sup>, and identifying temporal precedence of these relations is important. Using intensive longitudinal designs, it would be possible to examine 1) how between-person differences in pain-related anxiety may be associated with outcomes, and 2) how within-person fluctuations in pain-related anxiety may be associated with outcomes. It would then be possible to examine the trait or state-like nature of pain-related anxiety, and how it is differently related to the outcomes.

The results of the current study may have clinical implications. Given the observed associations between pain-related anxiety and the studied clinically important outcomes among adults with obesity, it may be important to assess levels of pain-related anxiety to determine those above the clinical cutoff score of 30<sup>43</sup>. Indeed, 73.9% of the current sample evinced clinically significant pain-related anxiety, which underscores the strong relation between clinical severe symptoms and poor physical and mental health outcomes. Thus, among those with elevated pain-related anxiety, it may be important to reduce pain-related anxiety using psychosocial interventions to reduce pain, mental health, and substance use outcomes. While no interventions have been specifically developed to target pain-related anxiety among adults with obesity and chronic pain, past research among chronic pain samples suggests that pain-related anxiety is malleable and targetable in treatment<sup>44,45</sup>. Decreases in pain-related anxiety have been associated with increased functional outcomes<sup>46</sup>, and these interventions can be easily adapted for adults with obesity.

The current study is not without limitations. First, the data were cross-sectional, prohibiting causal and temporal claims to be made. Additionally, all measures in the current study were collected via self-report, suggesting that the observed results may be due, in part, to shared

method variance. Incorporating multi-method measurement approaches, including objective pain testing (e.g. cold pressor task)<sup>47</sup>, behavioral tasks to measure pain-related anxiety<sup>48</sup>, and urine drug screens<sup>49</sup> may provide confirmatory evidence for the observed findings. Further, the current sample was primarily comprised of white female participants (81.2%) and, therefore, the results may not generalize to all adults with obesity and chronic pain. Future replication of the findings is warranted to increase confidence and generalizability. In addition, BMI was only associated with pain intensity, and none of the other variables, suggesting that some of the observed relations may not be due to obesity specifically; however, this may be due to the restricted range of BMI in the current sample, and future research should seek to replicate these findings. Finally, due to data collection limitations, information regarding comorbid health conditions (i.e. pain conditions) was not collected. Given that these health conditions may be associated with pain, opioid misuse, and mental health outcomes, future work should replicate the findings, controlling for these important variables.

The current study examined pain-related anxiety as a psychological correlate of pain, mental health, and substance use problems among adults with obesity and chronic pain. The results of the study provide support for pain-related anxiety being positively associated with these outcomes and suggests that pain-related psychological factors may be important to better understand pain experience and associated outcomes among adults with obesity. Although competing, reversal models cannot be ruled out based on these data, current findings provide preliminary empirical evidence for the clinical importance of pain-related anxiety in a host of physical and mental health conditions among adults with obesity and chronic pain. Future work is needed to further replicate and validate the hypothesized models and extend this work by evaluating the proposed associations in a longitudinal design to unequivocally discern the directionality of the supported relations.

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**Table 1.**

## Demographics

<b>Gender</b>	<i>N</i>	%
Female	134	81.7
Male	30	18.3
<b>Race/Ethnicity</b>	<i>N</i>	%
White/Caucasian	129	78.7
Hispanic/Latino	21	12.8
Black/African American	14	8.5
Native American/Alaska Native	6	3.7
Multiracial	3	1.8
Other	2	1.2
Preferred Not to Respond	1	0.6
<b>Level of Education</b>	<i>N</i>	%
Less than High School Education	5	3.0
Some High School Education	3	1.8
High School Diploma	53	32.3
Some College	42	25.6
Associate Degree	27	16.5
Bachelor's Degree	22	13.4
Master's Degree	9	5.5
Professional or Doctoral Degree	3	1.8
<b>Job Status</b>	<i>N</i>	%
Employed Full-time	58	35.4
Employed Part-time	14	8.5
Homemaker	23	14.0
Student	7	4.3
Unemployed	13	7.9
Retired	9	5.5
Disability	40	24.4

**Table 2.**

Descriptive statistics and bivariate correlations among study variables (n = 165).

Variable	Mean/n (SD)/%	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Age <sup>a</sup>	40.13 (10.85)	–								
2. Sex (female)	81.70	0.039	–							
3. BMI <sup>a</sup>	37.21 (6.70)	0.043	-0.004	–						
4. Pain-related anxiety <sup>b</sup>	52.59 (29.50)	-.230**	0.044	-0.047	–					
5. Pain Intensity <sup>c</sup>	22.34 (4.91)	0.065	0.073	0.140	.413**	–				
6. Pain Disability <sup>c</sup>	28.03 (8.50)	0.069	0.108	0.112	.315**	.569**	–			
7. Current Opioid Misuse <sup>c</sup>	15.41 (15.57)	-.271**	.227**	-0.055	.570**	.229**	.203**	–		
8. Opioid Dependence Severity <sup>c</sup>	3.71 (3.63)	-.189*	.234**	-0.087	.467**	.239**	.234**	.764**	–	
9. Anxiety Symptoms <sup>c</sup>	1.75 (1.94)	-.211**	0.053	-0.003	.490**	0.096	.182*	.545**	.472**	–
10. Depressive Symptoms <sup>c</sup>	1.87 (1.99)	-.175*	0.134	-0.006	.515**	0.120	.169*	.611**	.500**	.773**

Note.

\*\*\*  
p < .001

\*\*  
p < .01

\*  
p < .05.

<sup>a</sup> Covariate

<sup>b</sup> Predictor

<sup>c</sup> Criterion

Sex: % listed as females (Coded: 0 = Female, 1 = Male); BMI = Body Mass Index; Pain-related anxiety = Pain-related anxiety Symptoms Scale-Total Score (PASS; McCracken et al., 1992); Pain Intensity = Graded Chronic Pain Scale-Pain Intensity Subscale (GCPS; Von Korff, 2011); Pain Disability = Graded Chronic Pain Scale-Pain Disability Subscale (GCPS; Von Korff, 2011); Current Opioid Misuse = Current Opioid Misuse Measure-Total Score (COMM; Butler et al., 2007); Opioid Dependence Severity = Severity of Dependence Scale-Total Score (SDS; Gossop et al., 1995); Anxiety Symptoms = Patient Health Questionnaire-4-Anxiety Subscale (PHQ-4; Kroenke et al., 2009); Depressive Symptoms = Patient Health Questionnaire-4-Depression Subscale (PHQ-4; Kroenke et al., 2009).

**Table 3.**

## Hierarchical Regression Results

		<i>Pain Intensity</i>					
Model		<i>b</i>	<i>SE</i>	$\beta$	<i>t</i>	<i>p</i>	<i>sr</i> <sup>2</sup>
1	Age	0.026	0.035	0.057	0.727	0.468	0.003
	Sex	0.906	0.988	0.072	0.918	0.360	0.005
	BMI	0.101	0.057	0.138	1.769	0.079	0.019
2	Age	0.073	0.033	0.162	2.248	0.026	0.025
	Gender	0.600	0.887	0.047	0.677	0.499	0.002
	BMI	0.113	0.051	0.155	2.210	0.029	0.024
	Pain-related anxiety	0.076	0.012	0.455	6.328	<0.000	0.195
		<i>Pain Disability</i>					
Model		<i>b</i>	<i>SE</i>	$\beta$	<i>t</i>	<i>p</i>	<i>sr</i> <sup>2</sup>
1	Age	0.047	0.061	0.060	0.770	0.442	0.0036
	Gender	2.326	1.710	0.106	1.361	0.175	0.0113
	BMI	0.139	0.099	0.110	1.409	0.161	0.0121
2	Age	0.110	0.059	0.141	1.862	0.065	0.0187
	Gender	1.920	1.613	0.088	1.191	0.236	0.0076
	BMI	0.156	0.093	0.123	1.669	0.097	0.0150
	Pain-related anxiety	0.101	0.022	0.349	4.621	<0.000	0.1151
		<i>Current Opioid Misuse</i>					
Model		<i>b</i>	<i>SE</i>	$\beta$	<i>t</i>	<i>p</i>	<i>sr</i> <sup>2</sup>
1	Age	-0.400	0.106	-0.278	-3.774	<0.000	0.0773
	Gender	9.554	2.961	0.238	3.227	0.002	0.0565
	BMI	-0.099	0.171	-0.043	-0.579	0.563	0.0018
2	Age	-0.227	0.092	-0.158	-2.476	0.014	0.0235
	Gender	8.440	2.494	0.210	3.384	0.001	0.0440
	BMI	-0.055	0.144	-0.024	-0.380	0.705	0.0006
	Pain-related anxiety	0.276	0.034	0.523	8.198	<0.000	0.2580
		<i>Opioid Dependence Severity</i>					
Model		<i>b</i>	<i>SE</i>	$\beta$	<i>t</i>	<i>p</i>	<i>sr</i> <sup>2</sup>
1	Age	-0.065	0.025	-0.195	-2.592	0.010	0.0378
	Gender	2.256	0.702	0.241	3.213	0.002	0.0581
	BMI	-0.042	0.041	-0.078	-1.041	0.300	0.0061
2	Age	-0.032	0.023	-0.095	-1.369	0.173	0.0085
	Gender	2.041	0.632	0.218	3.228	0.002	0.0474
	BMI	-0.034	0.037	-0.062	-0.922	0.358	0.0039
	Pain-related anxiety	0.053	0.009	0.432	6.219	0.000	0.1761



*Anxiety Symptoms*

Model		<i>b</i>	<i>SE</i>	$\beta$	<i>t</i>	<i>p</i>	<i>sr</i> <sup>2</sup>
1	Age	-0.038	0.014	-0.214	-2.768	0.006	0.0456
	Gender	0.307	0.387	0.061	0.794	0.428	0.0038
	BMI	0.002	0.022	0.007	0.086	0.932	0.0000
2	Age	-0.019	0.013	-0.107	-1.511	0.133	0.0107
	Gender	0.184	0.345	0.037	0.533	0.595	0.0013
	BMI	0.007	0.020	0.024	0.344	0.731	0.0006
	Pain-related anxiety	0.031	0.005	0.465	6.581	0.000	0.2037

*Depressive Symptoms*

Model		<i>b</i>	<i>SE</i>	$\beta$	<i>t</i>	<i>p</i>	<i>sr</i> <sup>2</sup>
1	Age	-0.033	0.014	-0.181	-2.340	0.021	0.0325
	Gender	0.724	0.397	0.141	1.825	0.070	0.0198
	BMI	0.001	0.023	0.003	0.034	0.973	0.0000
2	Age	-0.012	0.013	-0.066	-0.958	0.340	0.0041
	Gender	0.588	0.346	0.114	1.699	0.091	0.0130
	BMI	0.006	0.020	0.021	0.308	0.758	0.0004
	Pain-related anxiety	0.034	0.005	0.496	7.168	0.000	0.2319

*N* for analyses is 164 cases. BMI = Body Mass Index; Pain-related anxiety = Pain-related anxiety Symptoms Scale-Total Score (PASS; McCracken et al., 1992); Pain Intensity = Graded Chronic Pain Scale-Pain Intensity Subscale (GCPS; Von Korff, 2011); Pain Disability = Graded Chronic Pain Scale-Pain Disability Subscale (GCPS; Von Korff, 2011); Current Opioid Misuse = Current Opioid Misuse Measure-Total Score (COMM; Butler et al., 2007); Opioid Dependence Severity = Severity of Dependence Scale-Total Score (SDS; Gossop et al., 1995); Anxiety Symptoms = Patient Health Questionnaire-4-Anxiety Subscale (PHQ-4; Kroenke et al., 2009); Depressive Symptoms = Patient Health Questionnaire-4-Depression Subscale (PHQ-4; Kroenke et al., 2009).