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PUBLISHED BY
ELSEVIER

The Journal of Pain, Vol xxx, No. xxx (xxxx), xxxx: xxx
Available online at www.jpain.org and www.sciencedirect.com

Vulnerability Factors, Adjustment, and Opioid Misuse in Chronic Noncancer Pain Individuals

Carmen Ramírez-Maestre,[*,†] Victoria Barrado-Moreno,[*] Rosa Esteve,[*,†] Elena R. Serrano-Íbañez,[*,†] Rocío de la Vega,[*,†] Gema T. Ruiz-Párraga,[*,†] Mariano Fernández-Baena,[‡] Mark P. Jensen,[§] and Alicia E. López-Martínez[*,†]

[*]*Department of Personality, Assessment and Psychological Treatment, Faculty of Psychology and Speech Therapy, University of Málaga, Andalucía Tech, Málaga, Spain,* [†]*Instituto de Investigación Biomédica de Málaga (IBIMA), Málaga, Spain,* [‡]*Pain Unit. Regional Hospital of Málaga, Málaga, Spain,* [§]*Department of Rehabilitation Medicine, University of Washington, Seattle, Washington*

Abstract: **Several person variables predate injury or pain onset that increase the probability of maladjustment to pain and opioid misuse. The aim of this study was to evaluate the role of 2 diathesis variables (impulsiveness and anxiety sensitivity [AS]) in the adjustment of individuals with chronic noncancer pain and opioid misuse. The sample comprised 187 individuals with chronic noncancer pain. The hypothetical model was tested using correlation and structural equation modeling analyses. The results show a significant association between impulsiveness and AS and all the maladjustment variables, and between impulsiveness and AS and opioid misuse and craving. However, although the correlation analysis showed a significant association between adjustment to pain and opioid misuse, the structural equation modeling analysis showed a nonsignificant association between them (as latent variables). The findings support the hypothesis that both impulsiveness and AS are vulnerability factors for maladaptive adjustment to chronic pain and opioid misuse.**

Perspective: ***This article adds to the empirical literature by including AS and impulsiveness as antecedent variables in a model of dual vulnerability to chronic pain maladjustment and opioid misuse. The findings suggest the potential utility of assessing both factors in individuals in the first stages of chronic pain.***

Keywords: *Chronic pain, impulsiveness, anxiety sensitivity, pain adjustment, opioid misuse*

Chronic pain is a complex phenomenon whose understanding and treatment require a multimodal biopsychosocial approach.[1-3] Pharmacological treatment is a common component of chronic pain management regimens and typically has the primary goal of reducing pain intensity.[4,5] Psychological interventions are also known to reliability reduce pain intensity, although they have the added aim of improving the individuals' overall adjustment to their chronic pain experience.[1,6,7]

Regarding psychological factors, the literature shows that there are several antecedent variables (ie, prior to injury or pain onset) that increase the probability of maladjustment to pain.[8-12] Two transdiagnostic variables have received particular empirical attention: impulsiveness and anxiety sensitivity (AS). Impulsiveness has been defined as a disposition toward rapid and unplanned reactions to stimuli without regard to the negative consequences of these behaviors.[13] Eysenck and Eysenck[14] related impulsivity to risk-taking, lack of planning, and making decisions quickly. AS was originally defined as fear of the expected negative consequences of anxiety and anxiety-related sensations.[15] The fear-avoidance model includes AS as a variable

Received February 16, 2024; Received in revised form June 3, 2024; Accepted June 8, 2024
Address reprint requests to Carmen Ramírez-Maestre, PhD, Departamento de Personalidad, Evaluación y Tratamiento Psicológico, Facultad de Psicología y Logopedia, Universidad de Málaga, Campus de Teatinos, 29071 Málaga, Spain.
Email: cramirez@uma.es
1526-5900/$36.00

https://doi.org/10.1016/j.jpain.2024.104606

present in individuals before pain onset.[16] In addition, impulsiveness[17-19] and AS[12,20,21] have also been considered to be potential risk factors for maladaptive coping with chronic pain.

Regarding maladjustment to pain, pain catastrophizing has been defined as the tendency to magnify the threat value of pain, to feel that it is uncontrollable or never-ending, and to ruminate on pain.[22] Research has established that it has negative consequences on the well-being of individuals with chronic pain.[22-25] As a process within the psychological flexibility model,[26] acceptance entails responding to stressful experiences (eg, pain flare-ups) without attempts to control or avoid such stressors, while engaging in valued daily activities despite their presence.[27] Several studies have found significant associations between pain nonacceptance and poor adjustment to chronic pain.[28-30] Other domains of adjustment to pain include anxiety, depression, physical functioning, overall level of impairment, and pain intensity.[31-38]

As mentioned at the beginning of this section, pharmacological treatment is a common component of chronic pain management regimens. This treatment includes nonopioid and opioid analgesics. Although opioid therapy is utilized for a broad range of chronic pain conditions,[39-42] several studies have highlighted the adverse effects of opioid medication in individuals with chronic pain. One of the most significant of these effects is the misuse of opioids,[43-46] which has been defined as the use of opioids in a manner other than how they are prescribed.[45] Prescription opioid misuse may involve a wide range of behaviors, including overuse.[45] The subjective experience of craving is related to overuse and has been defined as a strong desire to use drugs.[47] It has been the focus of numerous research studies on opioid craving as a key factor in continued opioid use.[48] Longitudinal studies have found an association between craving and the proximal risk of substance use.[49] Craving can also be a critical variable driving the use of opioids.[47]

The risk of prescription opioid misuse has also been hypothesized to be associated with the pain-related and transdiagnostic antecedent variables (ie, impulsiveness and AS) associated with poor adjustment in patients with chronic noncancer pain (CNCP)[50-64] referred to in the foregoing.

Although previous studies have investigated associations between each vulnerability factor and pain adjustment and opioid misuse, as far as we know, no previous research has studied all these variables within a hypothetical model. Given this background, the aim of this study was to test the hypothesized role of impulsiveness and AS as antecedent variables in poor adjustment to chronic pain and opioid misuse among individuals with CNCP. Fig 1 shows the hypothetical model within which this research was framed. The model proposes impulsiveness and AS as antecedent variables that would make individuals with chronic pain more vulnerable to poor adjustment (ie, pain catastrophizing, pain nonacceptance, pain intensity, anxiety and depression symptoms, low levels of physical functioning, and high levels of impairment) and opioid misuse following pain onset. The model also hypothesizes an association between opioid misuse and indices of poor adjustment to pain.

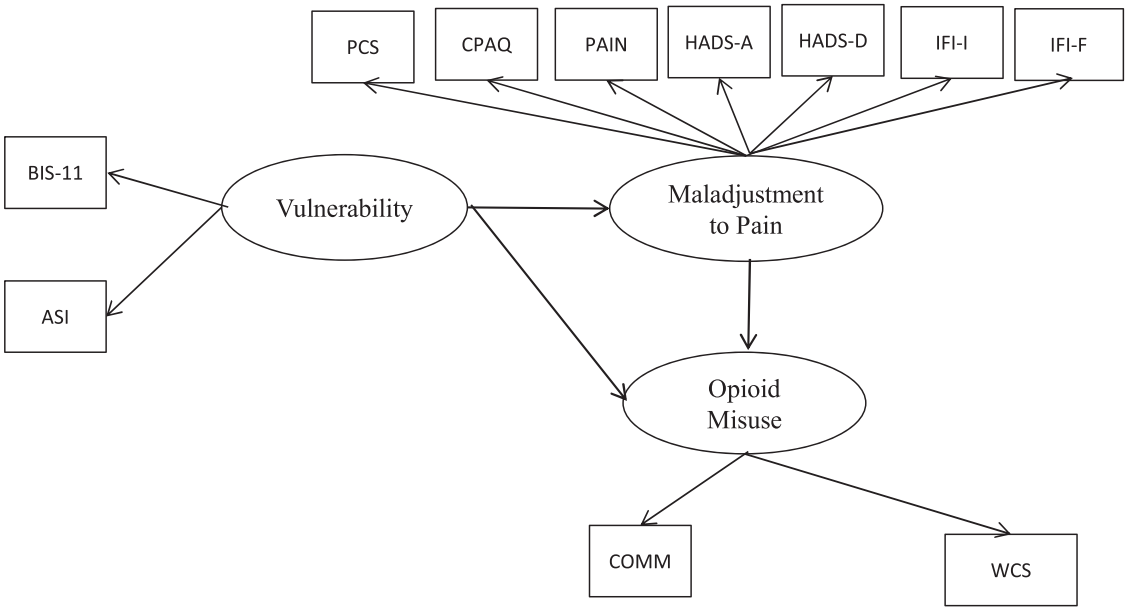

Figure 1. Original hypothesized model. Latent variables are represented by circles and observed variables by squares. Abbreviations: BIS-11, Barratt Impulsiveness Scale; PCS, Pain Catastrophizing Scale; PAIN, pain intensity; HADS-A, Anxiety subscale, Hospital Anxiety and Depression Scale; HADS-D, Depression subscale, Hospital Anxiety and Depression Scale; IFI-I, Impairment subscale, Impairment and Functioning Inventory; IFI-F, Functioning subscale, Impairment and Functioning Inventory; WCS, Weiss Craving Scale.

Methods

Participants

Kline[65] recommended a 10:1 ratio between the number of subjects and the number of estimated parameters required for structural equation modeling (SEM) analysis. Since we hypothesized 14 parameters (see Fig 1), 140 subjects should be sufficient for this study. The final sample consisted of 187 Spanish individuals (same race and ethnicity) with CNCP, who were recruited from 3 pain units of general hospitals. The recruitment process lasted from May 2021 to July 2022. Inclusion criteria were as follows: At the time of the study, they were experiencing CNCP and undergoing pharmacological treatment that included opioid analgesics for at least 3 months; and they were able to understand the Spanish language. Exclusion criteria were as follows: being treated for a malignancy; having a terminal illness; or having a severe psychiatric disorder (schizophrenia, psychotic disorders, etc) in the acute phase, as diagnosed by the mental health unit, that would interfere with participation. Four physicians treating the potential participants reviewed their patients' clinical history, and if the patients met the inclusion criteria, they were invited to participate. The physicians invited 339 patients with CNCP to participate and contacted the research team, who again screened the patients for eligibility and enrolled them if they were eligible and interested in participation. Of the 338 patients who contacted the study team, five were excluded from the study due to not meeting the inclusion and exclusion criteria, and 147 declined participation. The reasons for declining participation were as follows: Six patients did not reply to the phone calls; 45 did not attend the assessment session; 76 expressly refused; and 20 said that they could not travel to the hospital to attend the evaluation session. Thus, the final sample comprised 187 participants.

Procedures

All the procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national) and with the 1975 Declaration of Helsinki (revised 2000). This study is part of a research project that was approved by the Ethics Committee of the University of Málaga (CEUMA 2013-0016-H), and the Research Ethics Committee of the Province of Malaga (CEIP-281021). To ensure that the recruitment process was standardized, the researchers held a meeting with the recruiting physicians during which the eligibility criteria were described and recruitment procedures finalized. At the end of the appointment with their physician, each patient who was believed by the physician to meet the eligibility criteria was informed of the study aims and their participation was requested. Some patients were interviewed by research staff in person just after their appointment with their physician, whereas others provided their telephone numbers to make an appointment for a different day. Informed consent was obtained prior to data collection. The participants were aware that the information collected was confidential and that this information would be linked to a number alone and not to any identifying information. Each participant had a semistructured interview with a psychologist to obtain information about their demographic variables, social characteristics, and medical history. A battery of questionnaires was also completed by each participant during the interview. The interviews took about 90 minutes on average to complete. Neither the participants nor their referring physicians received any economic compensation for study participation.

Measures

Impulsiveness

The 30-item Spanish version of the Barratt Impulsiveness Scale for adults[66-68] was used to measure impulsiveness. Items describing different forms of impulsiveness are rated on a 4-point scale ranging from 1 ("Rarely or never") to 4 ("Always"). Higher total scores indicate higher levels of impulsiveness. The Spanish version of the scale shows good reliability and validity.[67] Internal consistency in our sample was adequate ($\alpha = .79$).

Anxiety Sensitivity

The 18-item Anxiety Sensitivity Index (ASI-3)[69] was used to measure the severity of AS symptoms. Items are rated on a 5-point scale ranging from 0 ("Very little") to 4 ("Very much"). If the total score is equal to or > 23, the respondents are classified as having a high level of AS.[70] The Spanish version of the ASI is fully equivalent to the original.[71] Internal consistency in the present study was excellent ($\alpha = .92$).

Pain Catastrophizing

The 13-item Pain Catastrophizing Scale[72] assesses the degree to which respondents experience various catastrophizing-related thoughts and feelings when in pain. Respondents indicate how often they have such thoughts on a 5-point scale ranging from 1 ("Never") to 4 ("Always"). Although the items can be scored to measure 3 components of catastrophizing (ie, rumination, magnification, and helplessness), we used the total score, which is the one most often used in research. The Spanish version of the scale shows appropriate reliability and validity.[73] Internal consistency in our sample was excellent ($\alpha = .91$).

Pain Acceptance

We administered the 20-item Spanish version of the Chronic Pain Acceptance Questionnaire (CPAQ-SV).[74,75] The items on the CPAQ can be scored on either of 2 subscales (Pain Willingness and Activity Engagement) or on both. The former subscale assesses a general willingness to experience pain, and the latter subscale measures engagement in activities despite pain (ie, the opposite of pain interference). Respondents rate how often they experience pain willingness and activity

engagement on a 7-point scale ranging from 0 ("Never") to 6 ("Always"). The CPAQ-SV is similar to the original scale in that it yields a total score and 2 subscale scores for Pain Willingness and Activity Engagement. This study only used the total score. The CPAQ-SV shows good internal consistency and good criterion validity.[75] Internal consistency in our sample was good (α = .89).

Anxiety and Depression

The Hospital Anxiety and Depression Scale is a self-reporting scale that contains 2 7-item subscales: one measures anxiety and the other measures depression.[76] These subscales are scored on a 4-point scale ranging from 1 ("Rarely") to 4 ("Often"). The Spanish version shows good reliability and validity.[77] This study used both subscales. The internal consistency of both scales in our sample was high (α = .85 for anxiety, α = .86 for depression).

Impairment and Daily Functioning

The 30-item Impairment and Functioning Inventory (IFI) asks respondents to indicate how often they engaged in activities relating to one of the following areas in the past week: household, autonomous behavior, leisure, and social relationships.[78,79] Respondents were first asked whether they performed a specific activity during the previous week. If they did so, they were asked to rate how often they did this on a 5-point scale ranging from 0 ("Never") to 4 ("10 or more times"). If they did not engage in the activity in the past week, they were asked whether they engaged in the activity prior to chronic pain onset. This approach differentiates between present functioning and impairment. The IFI was specifically developed to assess functioning and impairment in individuals with chronic pain. The instrument provides an index of functioning, an index of impairment, and scores for each of these areas. The internal consistency of the global scores in our sample demonstrated good reliability (α = .86 for functional status, α = .89 for functional impairment).

Pain Intensity

Participants were asked to rate their current pain intensity, as well as their least, average, and worst pain intensity during the past 2 weeks, on scales ranging from 0 ("No pain") to 10 ("Pain as intense as you could imagine"). A composite measure of characteristic pain intensity was computed for each participant by calculating the average of the least, average, worst, and current pain ratings. Such composite scores have been shown to be very reliable in individuals with chronic pain.[80] The internal consistency of the composite score in our sample indicated good reliability (α = .83).

Opioid Use

To assess opioid use, we asked participants about their current pain medications, dosages, and frequency of intake. We then computed morphine milligram equivalents using the methods recommended by Dowell et al.[41]

Misuse of Prescribed Opioids

The current abuse of prescribed opioids was assessed by means of the Spanish version of the Current Opioid Misuse Measure (COMM),[81,82] which is a brief self-assessment measure developed to monitor chronic pain patients on opioid therapy. The COMM comprises 17 items asking participants to rate how often they engaged in opioid misuse behavior in the past 30 days on a scale ranging from 0 ("Never") to 4 ("Very often"). The items are then summed to create a total score. A total score of 9 or more is considered to be an indication of high risk for opioid misuse. In our sample, the internal consistency of the measure was good (α = .81).

Craving

Craving was measured using the 5-item Weiss Craving Scale,[83,84] which has also been used in previous studies to assess craving for prescription opioids in individuals with chronic pain.[85,86] Respondents are asked to indicate the presence of this symptom during the last 24 hours on a scale ranging from 0 ("Not at all") to 9 ("Extremely intense"). In our sample, internal consistency was good (α = .88).

Statistical Analysis

Descriptive statistics were generated for the demographic, clinical, and other variables to describe the sample and study variables. We then conducted a series of analyses to test the theoretical model (see Fig 1). First, we computed Pearson correlation coefficients between the variables to be included in the model. Given that multiple comparisons were conducted, we only considered significant correlations with a $P \leq .001$. Next, we conducted a multivariate multiple regression using SEM to simultaneously determine the influence of all the predictor variables on all the dependent variables. According to Bollen and Pearl,[87] SEM is ideal for understanding how antecedent and intervening variables affect an outcome of interest. Variables in different parts of the model can be measured at different time points, but even with cross-sectional data, the analyst can assess the direct effect of a variable on an outcome as well as its indirect effect through an intervening variable. Bollen[88] emphasized the importance of theory in model-building, which characterizes SEM's confirmatory approach to understanding causal relationships.

Bootstrapping (n = 100 samples) was employed to evaluate potential bias. Bootstrapping provides repeated resampling of the original sample (with replacement) to create a sampling distribution that is not dependent on the parametric assumption of normality. Analyses were conducted using LISREL 8.30 software. The generally weighted least squares estimation method was applied because this method is effective for any data distribution, providing the analyses are performed on covariance matrices and asymptotic covariance matrices.[89] We used several goodness-of-fit indices to test the adequacy of the model. These included the root-mean-square error of approximation,

the goodness-of-fit index (GFI), and the adjusted goodness-of-fit index. The root-mean-square error of approximation is an absolute misfit index, in which values close to zero indicate the best fit, whereas values < .08 indicate an adequate fit.[90,91] The GFI and the adjusted goodness-of-fit index values range from 0 to 1, in which values close to 1 indicate the best fit.[92]

We hypothesized that significant positive associations would be found between the 3 latent variables: vulnerability, maladjustment to pain, and opioid misuse (see Fig 1). Eleven observable variables or indicators of the latent variables were used. According to the theoretical and empirical studies, explained above, vulnerability as a latent construct was specified by impulsivity (Barratt Impulsiveness Scale for adults) and AS (ASI-3). Maladjustment to pain was specified by pain catastrophizing (Pain Catastrophizing Scale), pain acceptance (CPAQ), pain intensity, anxiety, and depression symptoms (Hospital Anxiety and Depression Scale), and daily functioning and impairment (IFI). Since the emergence of fear-avoidance models of pain in the theoretical and empirical study of chronic pain, both pain catastrophizing and the lack of pain acceptance have been considered as core variables in the adjustment of individuals with chronic pain.[93,94] Although these 2 variables, as well as pain intensity, anxiety, and depression symptoms, and the level of functioning/impairment, are different concepts, the empirical literature states that they are all indicators of maladjustment of individuals with chronic pain. Therefore, they were included in the hypothetical model as part of the same latent variable. Finally, opioid misuse was specified by current opioid misuse (COMM) and craving (Weiss Craving Scale).

Results

Participants

Tables 1 and 2 show the participants' demographic and clinical characteristics.

Correlation Analyses

Table 3 presents the Pearson correlation coefficients between variables included in the hypothesized model.

Table 3 shows that all the associations between the antecedent variables and the variables thought to reflect pain maladjustment were in the expected directions. Most of the associations reached statistical significance ($P \leq .001$). That is, significant associations were found between most of the variables assumed to reflect poor adjustment to pain and opioid misuse and craving. Regarding the zero-order associations between the antecedent variables and opioid misuse, both impulsiveness and AS showed medium effect size and a significant association with current opioid misuse (r = .37 and .42 for impulsiveness and AS, $P < .001$, respectively), while craving showed a weak but significant association with impulsiveness (r = .25, $P < .001$) and a medium effect size and significant correlation with AS (r = .33, $P < .001$).

Table 1. Frequency Data for the Demographic Variables (N = 187)

VARIABLES	MEAN	SD	MIN/MAX
Age	56.1	11.6	24/85
Time in pain (months)	177.4	146.1	10/636
Pain intensity	6.6	1.6	1/10
	N	%	
Sex			
Men	64	34	
Women	123	66	
Marital status			
Single	20	11	
Married/unmarried couple	124	66	
Divorced/separated	31	17	
Widowed	12	6	
Education			
Reading and writing	13	7	
Primary school	48	26	
High school	92	49	
University education	34		
Work status			
Housekeeping	6	3	
Working	48	26	
Studying	2	1	
Unemployed	49	26	
Retired	82	44	

Abbreviation: SD, standard deviation.

Evaluation of the Hypothesized Model

Fig 2 shows the initial model and Table 4 the goodness-of-fit indices. According to Wang and Wang,[95] SEM is a multivariate statistical technique that assesses complex relationships between observed and latent variables. A critical step in SEM is model fit evaluation, which assesses the adequacy of the model to the observed data. During this process, redundant variables that do not contribute significantly to the model or are highly correlated with other variables may be identified. These variables might be removed to enhance the model's parsimony and accuracy. Therefore, the model respecification process may involve removing redundant variables based on statistical criteria such as parameter significance, or model fit indices. In order to develop a parsimonious model of the relationship between the variables, we examined the path coefficients and deleted from the model the paths that were not statistically significant. On this basis, first, we deleted the path from maladjustment to misuse. The modification indexes suggested multiple relationships between anxiety and depression and the other observed variables, including those variables that were hypothesized to reflect vulnerability and misuse. To improve model adjustment, we chose to exclude anxiety and depression (*redundant variables*) from the model. Consistent with these decisions, the goodness-of-fit indices calculated for the original model indicated that the model did not provide a good fit to the data. However, after the aforementioned changes to the adjustment model, the final model (see Fig 3) provided a good fit to the data. Table 4 shows the GFIs of the initial and final models. As hypothesized, the findings show a significant positive

Table 2. Frequency Data for the Clinical Variables (n = 187)

VARIABLES	N	%
Site of pain		
Head	78	42
Neck	103	55
Chest	40	21
Shoulders	110	59
Back (lumbar)	151	81
Arms	91	49
Hands	94	50
Hips	103	55
Thoracic	81	43
Legs	139	74
Feet	92	49
Diagnosis		
Widespread chronic pain	55	29
Complex regional pain syndrome	3	2
Primary musculoskeletal pain	14	8
Postsurgical/Post-traumatic	23	12
Neuropathic pain	14	8
Orofacial pain/headaches	1	1
Musculoskeletal pain	77	41
Medication		
Adjuvant medications for treating pain		
Benzodiazepines	134	77
Antidepressants	123	67
Antiepileptic drugs	102	55
Hypnotics	12	7
	Mean (min/max)	SD
Daily MME/d	58.1 (1.6/530)	78.1
Time in treatment with opioids (months)	46.8 (3/300)	50.9

Abbreviations: MME, morphine milligram equivalents; SD, standard deviation.
NOTE. MME = 58.1 is considered a moderate dose (Dowell et al[41]).

strong association between vulnerability in patients with CNCP and poor adjustment to pain and opioid misuse. However, contrary to expectations, no significant association was found between poor adjustment to pain and opioid misuse.

Conclusions

The aim of this study was to test the hypothesized role of impulsiveness and AS as antecedent variables of poor adjustment to chronic pain and opioid misuse in a sample of individuals with CNCP. The results of correlational analyses show associations in the expected directions between impulsiveness and AS and all the variables reflecting adjustment to chronic pain and opioid misuse. The great majority of these associations were statistically significant. Moreover, the results of the SEM analyses are consistent with those of the correlational analyses, suggesting that impulsiveness and AS are antecedent factors that may make individuals with CNCP more likely to exhibit poor adaptation to chronic pain and misuse of prescription opioids.

The study findings are in line with those of previous research which showed that impulsiveness and AS put individuals with chronic pain at risk of poor adjustment. For example, AS has been understood as a trait-like personality variable associated with the fear of anxiety-related sensations.[15] It has also been shown to be a strong predictor of pain intensity[20,50,96-100] and has been shown to have a strong association with catastrophizing, distress, pain intensity, and disability.[12,93,96,101,102] Similarly, previous research has found an association between AS and opioid misuse.[20] McNally[103] suggested that individuals with high AS experience fear arousal-related sensations, which make them more likely to use substances that reduce arousal (eg, anxiolytics and analgesics). There is considerable evidence to support this hypothesis.[50,52,53,104] According to the reciprocal model of pain and substance abuse,[105] in the context of comorbid pain and substance abuse, AS would be a leading transdiagnostic variable that should be targeted by interventions designed to break repeated cycles of pain and substance abuse.

The role that impulsiveness plays in addiction behavior has also been widely investigated, both in individuals with[5,56,106] and without[107] chronic pain. The current findings can also be discussed in the context of Gray's Reinforcement Sensitivity Theory.[108,109] According to

Table 3. Means, Standard Deviations, and Correlations Between the Model Variables

	MIN/MAX	M	SD	1	2	3	4	5	6	7	8	9	10	11
1. Impulsiveness	6/84	42.5	16.5	1										
2. Anxiety sensitivity	0/72	18.7	16.6	.28**	1									
3. Catastrophizing	13/52	36.3	10.3	.16*	41**	1								
4. Acceptance	4/110	47.1	25.2	−.16*	−.32**	−.64**	1							
5. Pain	1/10	6.6	1.6	.09	.23**	.29**	−.24**	1						
6. Anxiety	7/28	18.3	9.1	.44**	.44**	.51**	−.41**	.33**	1					
7. Depression	7/28	16.2	5.9	.35**	.40**	.46**	−.62**	.26**	.64**	1				
8. Impairment	0/23	6.1	5.6	.18*	.23**	.20*	−.38**	.19*	.24**	.46**	1			
9. Functioning	7/85	43.2	15.4	−.05	−.11	−.10	.30**	−.12	−.10	−.40**	−.71**	1		
10. Misuse (COMM)	0/52	13.2	9.3	.37**	.42**	.38**	−.38**	.21**	.40**	.46**	.25**	−.13	1	
11. Craving	0/45	14.3	14.1	.25**	.33**	.34**	−.34**	.29**	.26**	.24**	.23**	−.13	.39**	1

NOTE. Pearson's correlations. Significance level: $^{**}P < .001$: $^{*}P < .05$.
Abbreviation: SD, standard deviation.

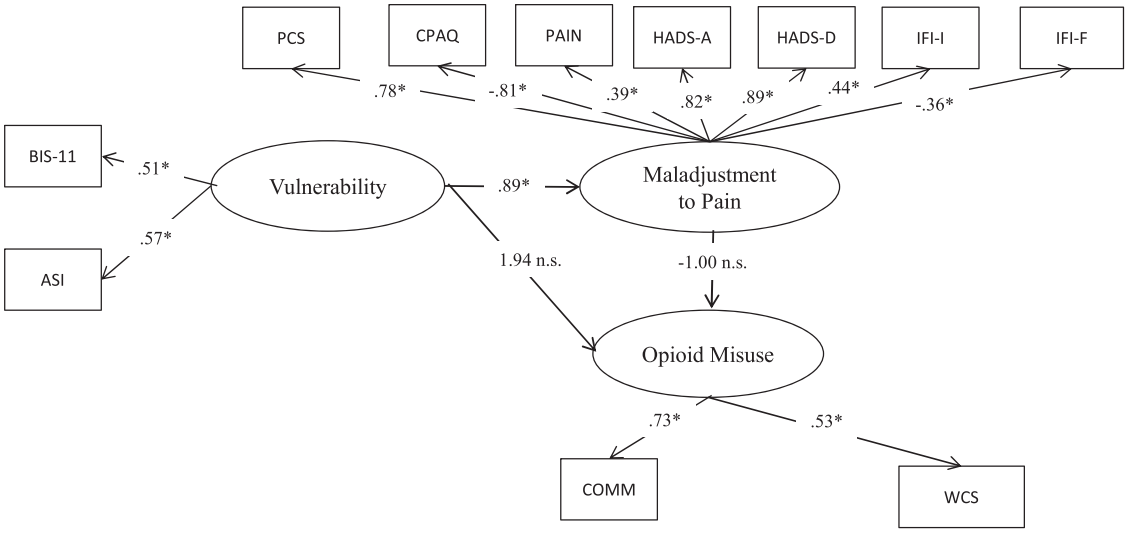

Figure 2. Initial model. Latent variables are represented by circles and observed variables by squares. Straight lines with arrows represent presumed paths, and values above the arrows represent standardized coefficients from bootstrapped estimates (*$P < .05$). Abbreviations: BIS-11, Barratt Impulsiveness Scale; PCS, Pain Catastrophizing Scale; PAIN, pain intensity; HADS-A, Anxiety subscale, Hospital Anxiety and Depression Scale; HADS-D, Depression subscale, Hospital Anxiety and Depression Scale; IFI-I, Impairment subscale, Impairment and Functioning Inventory; IFI-F, Functioning subscale, Impairment and Functioning Inventory; n.s., nonsignificant; WCS, Weiss Craving Scale.

Table 4. Goodness-of-Fit Indexes

	x^2 (df)	RMSEA	GFI	AGFI
Initial model	150.62 (40)	.12	.78	.65
Final model	30.60 (22)	.04	.96	.91

Abbreviations: RMSEA, root-mean-square error of approximation; AGFI, adjusted goodness-of-fit index.

Gray's theory, AS and impulsiveness can be viewed as being related to 2 neurophysiological systems that have been hypothesized to facilitate approach and avoidance behaviors: the behavioral inhibition system (BIS) and the behavioral activation system (BAS). This theory hypothesizes that the BIS is activated in the presence of cues indicating the potential for punishment,[108] which may be primed for activation in individuals who show higher levels of AS.[110,111] On the other hand, the BAS is activated in the presence of cues indicating the potential for reinforcement or the disappearance/omission of an expected negative stimulus.[108] Thus, individuals with higher trait levels of impulsiveness may be more prone to BAS activation.[112,113] It is relevant that the BIS and BAS have the potential to influence adjustment to chronic pain.[114,115] Previous research also supports an association between individuals with a tendency toward BIS or BAS activation and addiction and opioid misuse.[63,64] The results of the present study are in line with these previous results. These aspects could be investigated in future studies, which could include the specific assessment of the BIS and BAS using instruments such as the Sensitivity to Punishment and Sensitivity to Reward Questionnaire,[116] which has been previously used in Spanish chronic pain samples.[115,117,118]

We hypothesized that there would be a significant association between the latent factor representing poor adjustment to chronic pain and opioid misuse. However, although significant zero-order correlations were found between the measure of opioid misuse and many of the variables reflecting poor adjustment to chronic pain, a significant association was not found between the latent factor representing poor adjustment and the measure of opioid misuse in the SEM analysis. Previous results regarding the associations between adjustment to chronic pain and opioid misuse[57,58] should be reconsidered in light of these findings, because the zero-order associations found in this study and by other researchers may be due to their mutual association with dispositional factors.

The study findings have clinical relevance to the management of pain and opioid misuse. They suggest, for example, that it would be relevant to assess impulsivity and AS early after the onset of a chronic pain condition in order to identify individuals who may be at risk of developing problematic opioid use.[43,119] Several treatment guidelines have strongly recommended the psychological assessment of individuals with CNCP in order to evaluate their level of vulnerability to addiction and make informed decisions on the advisability of intervention with opioids or the need to conduct close monitoring of these individuals.[119-121] The results of the SEM analysis suggest the relevance of impulsiveness and AS as dispositional variables (present in individuals before pain onset) in the assessment of vulnerability to opioid misuse in individuals with CNCP (also see Marino et al[106]). Both variables could be part of a clinical intervention. Regarding impulsiveness, 2 targets seem to be effective for clinical intervention. On the one hand, emotion-related impulsivity can be addressed by brief interventions that teach individuals to recognize emotions, to use self-calming techniques in response to emotional states, and to preplan coping strategies to cope with highly

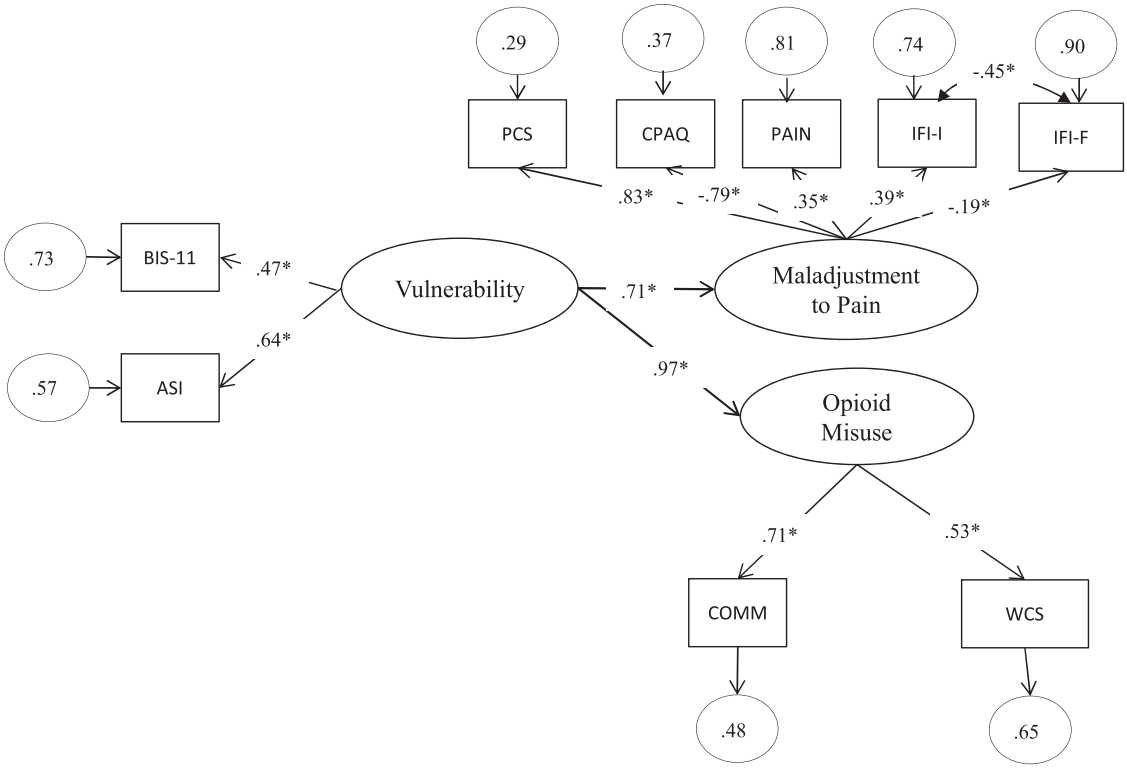

Figure 3. Final model (measurement and structural model) including the standardized coefficients. Latent variables are represented by circles and observed variables by squares. Circles are standardized error variances, straight lines with arrows represent presumed causal paths, values above the arrows represent standardized coefficients (*$P < .05$), and the curved line represents the correlation between the variables. Abbreviations: BIS, Barratt Impulsiveness Scale; PCS, Pain Catastrophizing Scale; PAIN, pain intensity; IFI-I, Impairment subscale, Impairment and Functioning Inventory; IFI-F, Functioning subscale, Impairment and Functioning Inventory; WCS, Weiss Craving Scale.

emotional states.[122] On the other hand, cognitive control training interventions have been shown to be effective in treating deficits in cognitive control.[123,124] Also, according to several studies, AS may be a target for therapeutic change within contextual behavioral and cognitive therapies, which include processes of acceptance, mindfulness, and values.[125,126]

The study has a number of limitations that should be considered when interpreting the results. First, there were more women in the sample. Thus, it remains unclear whether the findings can be generalized to samples that include more men. Also, the nonresponse bias in our sample could potentially limit the generalizability of our results. In addition, the cross-sectional study design prevented us from testing causal associations between the study variables. Longitudinal methods could be used in future studies to investigate the predictive value of the dispositional variables as factors that predict future function. Moreover, future longitudinal research could investigate the role of the BIS/BAS as predictors of adjustment to pain and opioid misuse.

Despite these limitations, the findings provide new information on the association between antecedent-trait variables and poor adjustment and opioid misuse. These results add to the empirical literature by including AS and impulsiveness as contributing factors in a model of dual vulnerability to chronic pain maladjustment and opioid misuse. Although previous studies have investigated associations between each factor and pain adjustment and opioid misuse, as far as we know, no previous research has studied all these variables within a hypothetical model. The findings suggest the potential usefulness of evaluating these 2 variables in individuals who are in the early stages of chronic pain in order to identify those who could benefit from interventions that attempt to modify both factors, especially if the individual is being considered for an opioid treatment.

Disclosures

This research was supported by grants from the Spanish Ministry of Science and Innovation (PID2019-106086RB-I00) and the Andalusian Regional Government (HUM-566; UMA20-FEDERJA-118). V.B.-M.'s work is supported by the Spanish Ministry of Science and Innovation with the contract PRE2020-093204. R.d.l.V.'s work is supported by the Spanish Ministry of Science and Innovation with a Ramon y Cajal contract (RYC2018-024722-I). G.T.R-P.'s work is

supported by the Andalusian Regional Government with the contract PREDOC-00023.

Funding for open access charge: Universidad de Málaga / CBUA.

No potential conflict of interest was reported by the authors.

Author Contributions

CR-M and **RE:** Study conceptualization, data preparation, data collection, data analysis, and report writing. **VB-M, RdlV, GTR-P,** and **MF-B:** Study conceptualization, data preparation, and report review. **ERS-I** and **AL-M:** Study conceptualization, data preparation, data analysis, and report review. **MPJ:** Study conceptualization, data analysis, and report review.

Author Note

This is an original analysis, and it was neither published nor sent anywhere. However, this study was part of a larger research project (Ramírez-Maestre C, López-Martínez AE, Esteve R. Predictive variables of prescription opioid misuse in patients with chronic noncancer pain. Development of a risk detection scale: a registered report protocol. *PLoS One* 2021;16(5):e0251586. doi: 10.1371/journal.pone.0251586).

Open Science Transparency Statements

- The study and analytic plan registration was published in Ramírez-Maestre C, López-Martínez AE, Esteve R. Predictive variables of prescription opioid misuse in patients with chronic noncancer pain. Development of a risk detection scale: a registered report protocol. *PLoS One* 2021;16(5):e0251586. doi: 10.1371/journal.pone.0251586.

Data Availability

The data are published here https://data.mendeley.com/datasets/vhn7cc9pny/1.

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