



The Adjective Rating Scale for Withdrawal: Validation of its ability to assess severity of prescription opioid misuse

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Abstract

Background: Withdrawal symptoms have been widely shown to be a useful indicator of the severity of opioid dependence. One of the most used instruments to assess them is the *Adjective Rating Scale for Withdrawal* (ARSW). However, there is a lack of adaptations and validations for its use with prescription opioids, even less for chronic pain patients under treatment with these analgesics. Thus, the aims of this study were to analyse the psychometric properties and invariance across gender of the ARSW in a sample of chronic noncancer pain patients.

Methods: Data were collected from 208 consumers of opioid medication, chronic noncancer pain patients. Participants completed sociodemographic, ARSW, prescription opioid dependence (DSM-IV-TR) and prescription opioid-use disorder (DSM-5) measurements. Gender invariance was assessed through multigroup confirmatory factor analysis (CFA).

Results: The ARSW showed a unidimensional factor structure and high internal consistency (Cronbach's alpha = 0.85). Multigroup CFA showed configural, metric, scalar and strict invariances of ARSW across gender. Predictive validity analyses indicated that ARSW has good capacity for identifying the severity of prescription opioid-use disorder, using both DSM-IV-TR and DSM-5 criteria.

Conclusions: These findings show that the ARSW is a valid and reliable tool for use in the assessment of the withdrawal of prescription opioids in chronic pain patients under treatment with these analgesics, regardless of their gender.

Significance: Findings supported the reliability and validity of the ARSW to assess withdrawal of prescription opioids in individuals with chronic noncancer pain. The instrument can be applied indistinctly in men and women. An increase in the ARSW scores could be used as an indicator of potential risk of prescription opioid-use disorder during long-term treatments.

1 | INTRODUCTION

The use of opioids as a treatment of chronic noncancer pain (CNCPP) has been associated with a remarkable growth in the number of prescriptions (Cooper et al., 2017; Gomes et al.,

2011; Ivanova et al., 2013; Simó Miñana, 2012) and, in turn, with an increase in rates of prescription opioid disorder, particularly in developed countries (Brady, McCauley & Back, 2015; Cheatle, 2015; Dowell, Haegerich & Chou, 2016; Edlund et al., 2014; Shei et al., 2015; Von Korff, 2013).

The subsequent involvement of prescription opioids in the growth of death rates due to overdose, admissions to treatment for abuse and other public health issues (Centers for Disease Control and Prevention, 2012; SAMHSA, 2013; Shei et al., 2015) makes the evaluation of opioid misuse variables vitally important. Not only to identify a possible improper use of these drugs, but also to predict and prevent its development in long-term users such as CNCP patients (Carballo et al., 2016; Chou et al., 2015; Dowell et al., 2016).

In this sense, the appearance of withdrawal signs has widely been shown to be a useful indicator of severity of opioid dependence (Ling et al., 2005; Tompkins et al., 2009; Vernon et al., 2016). The *Adjective Rating Scale for Withdrawal* (ARSW) (Amass, Kamien & Mikulich, 2000) is one of the most used instruments to assess withdrawal signs, which has been used in different contexts and investigations such as pharmacological treatment for opioid dependence, including prescription analgesics (Amass et al., 2000; Back et al., 2011; Bickel et al., 1988; Brown et al., 2010; Ling et al., 2005; Nielsen, Hillhouse, Thomas, Hasson & Ling, 2013; Potter et al., 2010). This unidimensional scale, initially made up of 20 Likert-type items (Bickel et al., 1988) and subsequently reduced to 16 (Amass et al., 2000), provides a global score (ranging between 9 and 144) that can be used as a subjective indicator of withdrawal (Amass et al., 2000; Ziedonis et al., 2009). The only review of ARSW's psychometric properties has shown high reliability (Cronbach's α higher than 0.9 in all the assessed groups) and an invariant factor structure as a function of gender and type of treatment received (Barbosa-Leiker, McPherson, Mamey, Burns & Roll, 2014).

However, despite the existence of specific tools like the ARSW to assess withdrawal, there are practically no adaptations and validations for their use with prescription opioids, even less for CNCP patients under treatment with these analgesics (Chou et al., 2015). Thus, in the absence of studies that evaluate the applicability of the ARSW in this population, the objectives of this study are (a) to analyse the psychometric properties of the ARSW (Amass et al., 2000), including its predictive validity regarding the severity of prescription opioid-use disorder, in a sample of CNCP patients; (b) to assess the fit of the unifactorial model obtained in its original validation (Barbosa-Leiker et al., 2014) in this sample; and (c) to examine its invariance across gender.

2 | MATERIAL AND METHODS

2.1 | Participants

A total of 231 CNCP patients from a Pain Unit (PU) of a General Hospital in Spain were assessed. Data were

collected from September 2014 to January 2017 from all patients who came to the PU. The study inclusion criteria were as follows: (a) being older than 18 years and (b) being at least 3 months in treatment with opioid medication at the time of the evaluation, which has been defined as long-term opioid therapy (Chou et al., 2015; Dowell et al., 2016). Patients who could not be properly assessed (due to the effects of a substance or neurological problems) or who could not finish the entire evaluation were not included in the study. After applying inclusion/exclusion criteria, the final sample size for the analysis was 208 long-term users of prescription opioids.

2.2 | Measures

The 16-items ARSW version (Amass et al., 2000) was used to assess prescription opioid withdrawal. Patients were asked to rate the severity of the symptoms during the last 24 hr, only if experienced between doses or when the patient skips or misses a dose. For this study, two independent translations were carried out (from English to Spanish), which did not show significant differences. Subsequently, the Spanish version was retranslated into English by another independent translator, without finding differences between this translation and the original version of the instrument.

Prescription opioid-use disorder was assessed using both DSM-IV-TR and new DSM-5 criteria. Dependence on opioid medication was assessed with a checklist with seven dichotomous items (yes/no) that reflect DSM-IV-TR criteria for psychoactive substance dependence (American Psychiatric Association, 2000). A score ≥ 3 is indicative of the presence of dependence.

DSM-5 opioid-use disorder (American Psychiatric Association, 2013) was assessed using DSM-IV-TR abuse criteria (except legal problems) and all DSM-IV-TR dependence criteria, except tolerance and withdrawal symptoms. Finally, craving criterion was assessed with the *Craving Scale of Weiss* (Weiss, Griffin & Hufford, 1995), which has been also used in previous studies to assess craving for prescription opioids among chronic pain patients (Martel et al., 2016; Wasan et al., 2012). Based on the number of criteria met, the severity of the disorder can be classified as mild (2–3 symptoms), moderate (4–5 symptoms) and severe (6 or more symptoms).

2.3 | Procedure

Recruitment and assessment of participants were conducted in the PU of the hospital, during the consultation hours. After signing an informed consent, the instruments were individually applied by trained psychologists in a 30-min interview. All patients who met inclusion criteria were

included in the full data set. No compensation was paid for participation. The study was approved by the Committee of Research and Ethics of the Miguel Hernández University and of the hospital (reference number DPS-JCC-01-13).

2.4 | Data analysis

Descriptive analyses were carried out for the 16 items of the ARSW. Internal consistency of the test was evaluated with Cronbach's alpha coefficient, considering alpha values above 0.70 as acceptable (Nunnally & Bernstein, 1994). Predictive validity of the ARSW in explaining severity of opioid-use disorder was calculated with simple linear regression analysis, using DSM-IV-TR dependence and DSM-5 prescription opioid-use disorder criteria sum-scores as the outcome variables. According to Cohen's convention (Cohen, 1988), r^2 values equal to or >0.25 were considered as a large explanatory power. The distribution of ARSW scores followed a normal distribution; therefore, t -test for independent samples was also calculated to analyse differences in the ARSW total score as a function of gender.

Lastly, a confirmatory factor analysis was conducted to examine the goodness of fit of the unifactorial structure proposed in the original validation (Barbosa-Leiker et al., 2014). Based on Hu and Bentler's recommendations (Hu & Bentler, 1999), adequacy of the models was assessed using the following fit indices: chi-square statistic (χ^2) and chi-square divided by degrees of freedom (χ^2/df) (Wheaton, Muthén, Alwin & Summers, 1977); Root Mean Square Error of Approximation (RMSEA) (Browne & Cudeck, 1993) and the Comparative Fit Index (CFI) (Bentler, 1990). Values of $\chi^2/df < 2$ (Carmines & McIver, 1981; Kline, 2005) and RMSEA ≤ 0.05 were indicators of good fit, considering RMSEA values up to 0.08 as adequate (Browne & Cudeck, 1993). Values of CFI ≥ 0.90 were also indicators of good fit (Bentler, 1990) and, between 0.08 and 0.90, were considered as acceptable (Garson, 2013).

The model's invariance was assessed through multigroup confirmatory factor analysis (MGCFA) following Brown's recommendation (Brown, 2006): first the confirmatory analysis was performed in two separate subsamples as a function of gender and, after confirming adequate fit, four simultaneous multigroup analyses, obtaining a baseline model to which increasing levels of constraints were imposed on regression weights, intercepts and residual variances. The estimation procedure used in these analyses was maximum likelihood (ML), and the ARSW items were modelled as continuous variables.

The above-mentioned fit indices and chi-square difference test for nested models ($\Delta\chi^2/\Delta df$) (Satorra & Bentler, 2001) were used to analyse and compare the obtained models. A significant test result indicates that the constraints applied to the most restrictive model are not supported, and the less parsimonious model presented the best fit to the

data (Milfont & Fischer, 2010). Given the sensitivity of this test to sample size, changes in the value of CFI were also used as a comparison criterion (ΔCFI) (Cheung & Rensvold, 2002), discarding the equivalence of the models if the value of ΔCFI is >0.01 in the restrictive model compared to the less restrictive model.

Data analyses were carried out with SPSS 20.0 and Amos 21. All the analyses were performed at a confidence level of 95%.

3 | RESULTS

3.1 | Participant characteristics

Of the 231 CNCP patients assessed, 23 participants were excluded because of being <3 months under opioid therapy (18 individuals), not finishing the entire evaluation (three individuals) and not understanding the interview due to neurological problems (two individuals). No data were missing for any variable.

Of the 208 final participants, 66.3% ($n = 138$) were women and mean age was 59.00 ± 14.32 years (range 25–94). Regarding job status, 41.8% ($n = 87$) were unemployed or on sick leave. The main reasons for seeking treatment were back pain (57.5%, $n = 119$), leg pain (15.9%, $n = 33$), and neck and shoulder pain (11.6%, $n = 24$). Average time in treatment with opioid medication was 2.40 ± 2.91 years. According to World Health Organization's analgesic scale, 27.4% ($n = 57$) were treated with weak or strong (45.2%, $n = 94$) opioids and a 27.4% ($n = 57$) used a combination of two or more opioids.

3.2 | Descriptive statistics and reliability

Table 1 shows the descriptive statistics of the ARSW items. The value of Cronbach's alpha coefficient indicates a high internal consistency of the test ($\alpha = 0.85$) in both gender groups (Table 1). Moreover, all the items of the ARSW show adequate discrimination indices, with 81% of the items obtaining values higher than 0.40. The items *excessive yawning*, *runny nose*, *poor appetite*, *excessive sneezing* and *abdominal cramps* presented the lowest values of discrimination index, although higher than 0.30. Internal consistency of the scale did not improve when eliminating them.

The mean total score of the ARSW was 53.71 ± 29.83 , with no statistically significant differences ($t_{206} = 0.249$, $p > 0.05$) between men (54.08 ± 29.93) and women (52.99 ± 29.85) and a small size effect (Cohen's $d = 0.04$).

3.3 | Confirmatory factorial analysis

Confirmatory factor analysis (CFA) was conducted with the scores of the 16 items of the instrument to assess the

TABLE 1 Reliability coefficients and mean item scores of the ARSW

ARSW items (<i>n</i> = 208) ^a	Mean (<i>SD</i>)	Discrimination index	α if item deleted
1. Muscle cramps	3.89 (3.66)	0.44	0.841
2. Depressed or sad	5.11 (3.63)	0.60	0.832
3. Painful joint	5.90 (3.55)	0.54	0.835
4. Excessive yawning	2.20 (3.20)	0.39	0.843
5. Hot or cold flashes	3.40 (3.63)	0.53	0.836
6. Trouble getting to sleep	4.84 (3.95)	0.55	0.835
7. Sick to stomach	1.42 (2.65)	0.46	0.840
8. Irritable	3.51 (3.61)	0.55	0.835
9. Runny nose	1.48 (2.75)	0.32	0.846
10. Poor appetite	2.33 (3.34)	0.33	0.846
11. Weak knees	4.60 (3.95)	0.44	0.842
12. Excessive sneezing	1.44 (2.59)	0.33	0.846
13. Tense, jittery	4.79 (3.56)	0.57	0.836
14. Watery eyes	2.46 (3.32)	0.44	0.841
15. Abdominal cramps	1.16 (2.51)	0.38	0.844
16. Fitful sleep	5.17 (3.66)	0.57	0.833

^aInternal consistency total scale: $\alpha = 0.85$ (Men: $\alpha = 0.86$; Women: $\alpha = 0.85$).

fit of the data to the unifactorial structure proposed in the original validation of the ARSW (Barbosa-Leiker et al., 2014). The observed variables (items) and the latent variable (factor) are represented as rectangles and a circle, respectively, in Figure 1. As was done in that validation, given the similarity and possible relationship between some symptoms, correlation of error variances of the following five pairs of items was allowed: *muscle cramps-painful joints*, *painful joints-weak knees*, *trouble getting to sleep-fitful sleep*, *irritable-tense/jittery* and *runny nose-excessive sneezing* (Figure 1). The results ($\chi^2/df = 1.752$, CFI = 0.91, RMSEA = 0.06) showed that the model adequately represents the data, indicating a good fit.

When comparing the data with those obtained when applying the original structure with seven correlated errors in this sample, this model showed a greater goodness of fit than the original validation (Table 2), and the improvement in the RMSEA value was determinant to confirm the adequacy of the model for the population examined.

3.4 | Measurement invariance across gender

In order to assess if the ARSW was measurement invariant with respect to gender, the data matrix was divided into

two groups: men ($n = 70$) and women ($n = 138$) and individual CFAs were conducted for the groups separately. The initial estimation of gender invariance showed appropriate fit indices in both subsamples (Table 3), indicating a similar factor structure across groups. Therefore, MGCFA analyses were carried out.

3.4.1 | Configural invariance

A baseline model without constraints was established in order to examine configural invariance across each group. The results showed that this basic model structure was equivalent across gender (Table 3). Subsequently, increasing level of constraints was imposed on regression weights (metric invariance), intercepts (scalar invariance) and residual variances (error invariance). The model fit was assessed at each level of invariance.

3.4.2 | Metric invariance

Good fit indices were found when constraining the regression coefficients to be equal across both gender groups (metric invariance model). When comparing this model to the configural invariance model, the chi-square difference test ($p > 0.05$) and the change in CFI value ($\Delta CFI = 0.00$) showed that the restrictions applied do not result in a significant worsening of the model fit (Table 3). Thus, metric invariance was supported, indicating that individuals responded to the items in the same way, so the measurement units of the scale are identical across the two groups.

3.4.3 | Scalar invariance

In order to assess if the latent means can be compared across the groups, the ARSW was also examined for scalar invariance by constraining factor loadings and intercepts to be the same across groups. Fit indices supported scalar invariance as well, which indicates that the scores of both groups also have the same origin of the scale. Scalar invariance was achieved with a $\Delta CFI = -0.01$ and a non-significant χ^2 difference test (Table 3).

3.4.4 | Error invariance

Finally, residual variances were also restrained to be equal across the groups. This more constrained model also fits the data well (Table 3) and did not result in a poorer model fit compared to the scalar model (residual variances model vs. scalar model: $\chi^2 = 349.33$, $df = 251$, $p > 0.05$, $\Delta CFI = -0.01$). Thus, error invariance was supported, which means that the measurement errors are similar across groups and the construct is measured with the same precision, regardless of their gender.

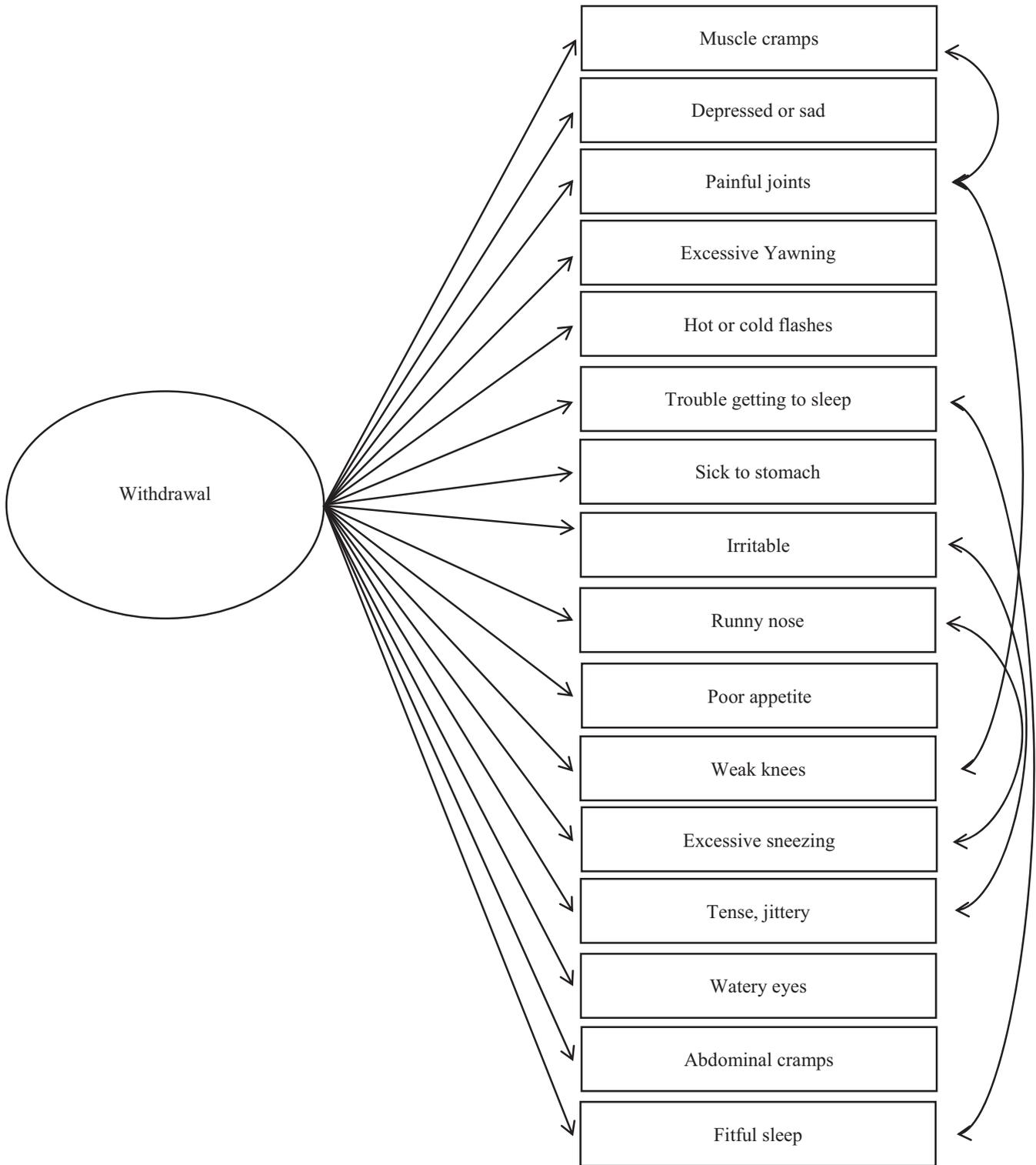


FIGURE 1 The 1-factor model of the ARSW with five correlated residuals: *muscle cramps-painful joints*, *painful joints-weak knees*, *trouble getting to sleep-fitful sleep*, *irritable-tense/jittery* and *runny nose-excessive sneezing*. Latent factor is shown in oval and observed variables are shown in rectangles. Only correlated error variances are shown to increase readability

3.5 | Predictive validity

Simple linear regression analysis pointed out that the ARSW score had a significant predictive power for the severity of prescription opioid-use disorder, using both

DSM-IV-TR and DSM-5 criteria sum-scores. Concretely, the ARSW total score was found to be positively associated with the number of DSM-IV-TR dependence criteria met ($\beta = 0.51, p < 0.001$), accounting for 26% ($r^2 = 0.26$) of the variance explained. This regression coefficient of

TABLE 2 Fit indices for one-factor models with seven correlated residuals (original validation) and five correlated residuals (chronic pain validation)

Model	χ^2	df	p	χ^2/df	RMSEA	CFI
Original validation model	212.190	97	<0.001	2.188	0.076	0.857
Chronic pain validation model	173.463	99	<0.001	1.752	0.060	0.908

0.51 means that the severity of opioid-use disorder increases by 0.51 per point increase on the ARSW scores. Concerning DSM-5 prescription opioid-use disorder criteria, the ARSW was also positively associated with the total criteria met ($\beta = 0.46$, $p < 0.001$), indicating an increase in the severity of the disorder by 0.46 per point increase on the ARSW and accounting for 22% ($r^2 = 0.22$) of the variance explained.

4 | DISCUSSION

Due to the lack of instruments for assessing withdrawal from prescription opioids, the aims of this study were to analyse the psychometric properties and applicability of the ARSW (Amass et al., 2000) in a sample of CNCP patients. The results obtained in the present study show that the ARSW is a valid and reliable tool for use in the assessment of withdrawal in patients with CNCP who are long-term users of opioid medication.

The scale presents high internal consistency, with alphas of 0.86 and 0.85 for men and women, respectively. These findings coincide with the results from the original validation of this instrument (Barbosa-Leiker et al., 2014), which was performed with another type of population (individuals with an opioid-use disorder in treatment for addiction with

buprenorphine/naloxone). The results confirm a good fit of the unifactorial structure of the ARSW in CNCP patients, supporting the use of a single overall score of withdrawal symptoms (Barbosa-Leiker et al., 2014).

Moreover, as gender has been pointed out as a relevant factor in prescription opioid-use disorder (Choo, Douriez & Green, 2014; Cochran et al., 2014; Han, Kass, Wilsey & Li, 2013; Kaye et al., 2017; Kerridge et al., 2015), measurement invariance was tested to assess if the ARSW was sensitive to gender characteristics. No reduction in the goodness of fit of the model was observed as restrictions were incorporated, reaching the highest level of invariance with appropriate fit indices (CFI = 0.88 and RMSEA = 0.04). This ratifies that the instrument measures withdrawal symptoms equally in men and women.

Lastly, regarding predictive validity, the ARSW appears to be a valid tool to predict the severity of prescription opioid dependence and use disorder, according to DSM-IV-TR and DSM-5 criteria. Despite that withdrawal is no longer included as a criterion for opioid-use disorder when occurring under proper medical supervision (American Psychiatric Association, 2013; Hasin et al., 2013), recent research suggested that this exclusion does not apply when individuals use prescription opioids in larger amounts or for longer periods than recommended by a healthcare provider (Kerridge et al., 2015; Saha et al., 2016). In this sense, our findings reveal that higher levels of withdrawal intensity and therefore an increase in ARSW scores could be used as an indicator of potential risk of prescription opioid-use disorder, just as these researchers suggested.

The findings of this study are very important for the area of treatment of CNCP, both at the clinical level and for research. Having shown its good psychometric properties also in CNCP patients, its use in research would allow improving the evaluation of factors associated with the development of an addictive process. This evaluation could help to create preventive strategies and to plan treatments with opioid medication to minimize the onset of addiction

TABLE 3 Goodness-of-fit indices for ARSW invariance tests across gender and comparison of nested models

	χ^2 (df)	χ^2/df	RMSEA	CFI	Comparison	$\Delta\chi^2$ (Δdf)	ΔCFI	Decision
Single-group CFA								
Men	120.53 (99)	1.22	0.06	0.93				
Women	162.68 (99)**	1.64	0.07	0.88				
Multigroup CFA (across gender)								
Model 0 ^a	283.39 (198)**	1.43	0.05	0.90				
Model 1 ^b	299.56 (213)**	1.41	0.04	0.90	Model 1 vs. 0	16.17 (15)	0.00	Accept
Model 2 ^c	318.60 (229)**	1.39	0.04	0.89	Model 2 vs. 1	19.03 (16)	-0.01	Accept
Model 3 ^d	349.33 (251)**	1.39	0.04	0.88	Model 3 vs. 2	30.73 (22)	-0.01	Accept

Notes. ^aunconstrained model; equality constraints imposed on: ^bregression weights, ^cintercepts, ^dresidual variances. ** $p < 0.01$.

(Carballo et al., 2016; Chang & Compton, 2013; Morgan, Weaver, Sayeed & Orr, 2013; Sehgal, Manchikanti & Smith, 2012).

Likewise, at the clinical level, it could be used as a control tool and periodic follow-up which can be applied indistinctly in men and women, during the course of a treatment with opioid analgesics. The information provided would be very useful to plan medication protocols and to adapt them to the patient's features, the effects of the treatment and the risk of developing addiction (Carballo et al., 2016). Since patients sometimes did not recognize or identify an inappropriate use of the treatment (Carballo et al., 2016), the characteristics of the ARSW (self-report, rapid and noninvasive) could facilitate the clinician's work, allowing to identify a potential prescription opioid-use disorder without directly asking the central question.

The study presents some limitations. Firstly, the limitations inherent when using self-reports, which were minimized by administrating the instrument in personal interviews. Face-to-face administration has been pointed out as a good way to detect possible underestimation or overestimation of the patient's responses and to clarify questions (Edwards, 2010). In addition, recent drug abuse is more likely to be reported in face-to-face surveys (Pridemore, Damphousse & Moore, 2005), which have shown good agreement with pharmacy records of continuous-use medication (Moraes, Mengue & Pizzol, 2017).

Secondly, as there are no other validated instruments for the assessment of withdrawal symptoms in CNCP patients, the concurrent validity of the instrument could not be measured. Therefore, in order to complete this validation process, longitudinal studies are recommended for measuring withdrawal symptoms in different phases of the treatment of CNCP along with other variables related to addiction to prescription opioid, which would also confirm the predictive validity of the instrument.

Nevertheless, the ARSW has proven to be an instrument with good psychometric properties, easy to apply, score and interpret. These features, along with the lack of other adapted and validated instruments, make the ARSW a tool of reference for the evaluation of withdrawal symptoms associated with the consumption of opioid medication in patients with CNCP.

CONFLICT OF INTEREST

All authors declare that they have no conflict of interests.

AUTHORS' CONTRIBUTION

All authors contributed to the design of the study, discussed the results and commented on the manuscript. A. Coloma-Carmona participated in data collection, conducted

the statistical analysis and participated in the writing of the whole manuscript. J.L. Carballo participated in the conception and design of the study and participated in the writing of the results and discussion section of the manuscript. J. Rodríguez-Marín participated in the interpretation of data and in the writing of the introduction and methods section. C.J. van-der Hofstadt participated in data collection and in the writing of the introduction and discussion section. All authors approved the final version of the manuscript.

REFERENCES

- Amass, L., Kamien, J. B., & Mikulich, S. K. (2000). Efficacy of daily and alternate-day dosing regimens with the combination buprenorphine-naloxone tablet. *Drug and Alcohol Dependence*, 58, 143–152. [https://doi.org/10.1016/S0376-8716\(99\)00074-5](https://doi.org/10.1016/S0376-8716(99)00074-5)
- American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders: DSM-IV-TR (Text Revision)*. Washington, DC: American Psychiatric Association.
- American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders*. Arlington, DC: American Psychiatric Association.
- Back, S. E., Payne, R. L., Wahlquist, A. H., Carter, R. E., Stroud, Z., Haynes, L., ... Ling, W. (2011). Comparative profiles of men and women with opioid dependence: Results from a national multisite effectiveness trial. *American Journal of Drug and Alcohol Abuse*, 37, 313–323. <https://doi.org/10.3109/00952990.2011.596982>
- Barbosa-Leiker, C., McPherson, S., Mamey, M. R., Burns, G. L., & Roll, J. (2014). Psychometric properties of the adjective rating scale for Withdrawal across treatment groups, gender, and over time. *Journal of Substance Abuse Treatment*, 46, 251–256. <https://doi.org/10.1016/j.jsat.2013.08.020>
- Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, 107, 238–246. <https://doi.org/10.1037/0033-2909.107.2.238>
- Bickel, W. K., Stitzer, M. L., Bigelow, G. E., Liebson, I. A., Jasinski, D. R., & Johnson, R. E. (1988). A clinical trial of buprenorphine: Comparison with methadone in the detoxification of heroin addicts. *Clinical Pharmacology and Therapeutics*, 43, 72–78. <https://doi.org/10.1038/clpt.1988.13>
- Brady, K. T., McCauley, J. L., & Back, S. E. (2015). Prescription opioid misuse, abuse, and treatment in the United States: An update. *American Journal of Psychiatry*, 173, 18–26.
- Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. New York, NY: Guilford.
- Brown, E. S., Tirado, C., Minhajuddin, A., Hillhouse, M., Adinoff, B., Ling, W., ... Thomas, C. (2010). Association of race and ethnicity with withdrawal symptoms, attrition, opioid use and side-effects during buprenorphine therapy. *Journal of Ethnicity in Substance Abuse*, 9, 106–114. <https://doi.org/10.1080/15332641003772587>
- Browne, M. W., & Cudeck, R. (1993). Alternative ways of assessing model fit. In K. A. Bollen, & J. S. Long (Eds.), *Testing structural equation models* (pp. 136–162). Newbury Park, CA: Sage.
- Carballo, J. L., Coloma-Carmona, A., Mrozowicz-Gaudyn, D., Vidal Arenas, V., van der Hofstadt-Román, C. J., & Rodríguez-Marín, J. (2016). Psychological assessment of opioid drug abuse. *Papeles del Psicólogo*, 37, 45–51.

- Carmines, E. G., & McIver, S. P. (1981). Analyzing models with unobserved variables: Analysis of covariance structures. In G. W. Bohmstedt, & E. F. Borgatta (Eds.), *Social measurement: Current issues* (pp. 66–115). Beverly Hills, CA: Sage.
- Centers for Disease Control and Prevention (2012). CDC grand rounds: Prescription drug overdoses - a U.S. epidemic. *MMWR. Morbidity and Mortality Weekly Report*, *61*, 10–13.
- Chang, Y.-P., & Compton, P. (2013). Management of chronic pain with chronic opioid therapy in patients with substance use disorders. *Addiction Science and Clinical Practice*, *8*, 21. <https://doi.org/10.1186/1940-0640-8-21>
- Cheatle, M. D. (2015). Prescription opioid misuse, abuse, morbidity, and mortality: Balancing effective pain management and safety. *Pain Medications*, *16*, S3–S8. <https://doi.org/10.1111/pme.12904>
- Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling: A Multidisciplinary Journal*, *9*, 233–255. https://doi.org/10.1207/S15328007SEM0902_5
- Choo, E. K., Douriez, C., & Green, T. (2014). Gender and prescription opioid misuse in the emergency department. *Academic Emergency Medicine*, *21*, 1493–1498. <https://doi.org/10.1111/acem.12547>
- Chou, R., Turner, J. A., Devine, E. B., Hansen, R. N., Sullivan, S. D., Blazina, I., ... Deyo, R. D. (2015). The effectiveness and risks of long-term opioid therapy for chronic pain: A systematic review for a national institute of health pathways to prevention workshop effectiveness and risks of long-term opioid therapy for chronic pain. *Annals of Internal Medicine*, *162*, 276–286. <https://doi.org/10.7326/M14-2559>
- Cochran, B. N., Flentje, A., Heck, N. C., Van Den Bos, J., Perlman, D., Torres, J., ... Carter, J. (2014). Factors predicting development of opioid use disorders among individuals who receive an initial opioid prescription: Mathematical modeling using a database of commercially-insured individuals. *Drug and Alcohol Dependence*, *138*, 202–208. <https://doi.org/10.1016/j.drugalcdep.2014.02.701>
- Cohen, J. (1988). *Statistical power analysis for the behavioural science*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Cooper, A. J. M., Willis, J., Fuller, J., Benecke, H., Leighton-Scott, J., Andersohn, R., ... Knaggs, R. D. (2017). Prevalence and incidence trends for diagnosed prescription opioid use disorders in the United Kingdom. *Pain and Therapy*, *6*, 73–84. <https://doi.org/10.1007/s40122-017-0070-9>
- Dowell, D., Haegerich, T. M., & Chou, R. (2016). CDC guideline for prescribing opioids for chronic pain — United States, 2016. *MMWR - Recommendations and Reports*, *65*, 1–49. <https://doi.org/10.15585/mmwr.rr6501e1>
- Edlund, M. J., Martin, B. C., Russo, J. E., DeVries, A., Braden, J. B., & Sullivan, M. D. (2014). The role of opioid prescription in incident opioid abuse and dependence among individuals with chronic noncancer pain: The role of opioid prescription. *Clinical Journal of Pain*, *30*, 557–564.
- Edwards, P. (2010). Questionnaires in clinical trials: Guidelines for optimal design and administration. *Trials*, *11*, 2–8. <https://doi.org/10.1186/1745-6215-11-2>
- Garson, G. D. (2013). *Factor analysis*. Asheboro, NC: Statistical Associates Publishers.
- Gomes, T., Juurlink, D. N., Dhalla, I. A., Mailis-Gagnon, A., Paterson, J. M., & Mamdani, M. M. (2011). Trends in opioid use and dosing among socio-economically disadvantaged patients. *Open Medicine*, *5*, e13–e22.
- Han, H., Kass, P. H., Wilsey, B. L., & Li, C.-S. (2013). Age, gender, and earlier opioid requirement associations with the rate of dose escalation in long-term opioid therapy. *Journal of Opioid Management*, *9*, 129–138.
- Hasin, D. S., O'Brien, C. P., Auriacombe, M., Borges, G., Bucholz, K., Budney, A., ... Grant, B. F. (2013). DSM-5 criteria for substance use disorders: Recommendations and rationale. *American Journal of Psychiatry*, *170*, 834–851. <https://doi.org/10.1176/appi.ajp.2013.12060782>
- Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*, 1–55. <https://doi.org/10.1080/10705519909540118>
- Ivanova, J. I., Birbaum, H. G., Yushkina, Y., Sorg, R. A., Reed, J., & Merchant, S. (2013). The prevalence and economic impact of prescription opioid-related side effects among patients with chronic noncancer pain. *Journal of Opioid Management*, *9*, 239–254. <https://doi.org/10.5055/jom.2013.0165>
- Kaye, A. D., Jones, M. R., Kaye, A. M., Ripoll, J. G., Galan, V., Beakley, B. D., ... Manchikanti, L. (2017). Prescription opioid abuse in chronic pain: An updated review of opioid abuse predictors and strategies to curb opioid abuse: Part 1. *Pain Physician*, *20*, S93–S109.
- Kerridge, B. T., Saha, T. D., Chou, S. P., Zhang, H., Jung, J., Ruan, W. J., ... Hasin, D. S. (2015). Gender and nonmedical prescription opioid use and DSM-5 nonmedical prescription opioid use disorder: Results from the national epidemiologic survey on alcohol and related conditions – III. *Drug and Alcohol Dependence*, *156*, 47–56. <https://doi.org/10.1016/j.drugalcdep.2015.08.026>
- Kline, R. B. (2005). *Principles and practice of structural equation modeling*, 2nd edn. New York, NY: Guilford Press.
- Ling, W., Amass, L., Shoptaw, S., Annon, J. J., Hillhouse, M., Babcock, D., ... Buprenorphine Study Protocol Group. (2005). A multi-center randomized trial of buprenorphine-naloxone versus clonidine for opioid detoxification: Findings from the National Institute on Drug Abuse Clinical Trials Network. *Addiction (Abingdon, England)*, *100*, 1090–1100. <https://doi.org/10.1111/j.1360-0443.2005.01154.x>
- Martel, M. O., Finan, P. H., McHugh, R. K., Issa, M., Edwards, R. R., Jamison, R. N., & Wasan, A. D. (2016). Day-to-day pain symptoms are only weakly associated with opioid craving among patients with chronic pain prescribed opioid therapy. *Drug and Alcohol Dependence*, *162*, 130–136. <https://doi.org/10.1016/j.drugalcdep.2016.02.047>
- Milfont, T. L., & Fischer, R. (2010). Testing measurement invariance across groups: Applications in crosscultural research. *International Journal of Psychological Research*, *1*, 111–121. <https://doi.org/10.21500/20112084.857>
- Moraes, C. G., Mengue, S. S., & Pizzol, T. D. S. D. (2017). Agreement between different recall periods in drug utilization studies. *Revista Brasileira de Epidemiologia*, *20*, 324–334. <https://doi.org/10.1590/1980-5497201700020012>
- Morgan, L., Weaver, M., Sayeed, Z., & Orr, R. (2013). The use of prescription monitoring programs to reduce opioid diversion and improve patient safety. *Journal of Pain and Palliative Care Pharmacotherapy*, *27*, 4–9. <https://doi.org/10.3109/15360288.2012.738288>
- Nielsen, S., Hillhouse, M., Thomas, C., Hasson, A., & Ling, W. (2013). A comparison of buprenorphine taper outcomes between

- prescription opioid and heroin users. *Journal of Addiction Medicine*, 7, 33–38. <https://doi.org/10.1097/ADM.0b013e318277e92e>
- Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory*. New York, NY: McGraw-Hill, Inc.
- Potter, J. S., Chakrabarti, A., Domier, C. P., Hillhouse, M. P., Weiss, R. D., & Ling, W. (2010). Pain and continued opioid use in individuals receiving buprenorphine-naloxone for opioid detoxification: Secondary analyses from the clinical trials network. *Journal of Substance Abuse Treatment*, 38, S80–S86. <https://doi.org/10.1016/j.jsat.2009.12.007>
- Pridemore, W. A., Damphousse, K. R., & Moore, R. K. (2005). Obtaining sensitive information from a wary population: A comparison of telephone and face-to-face surveys of welfare recipients in the United States. *Social Science and Medicine*, 1982(61), 976–984. <https://doi.org/10.1016/j.socscimed.2005.01.006>
- Saha, T. D., Kerridge, B. T., Goldstein, R. B., Chou, S. P., Zhang, H., Jung, J., ... Grant, B. F. (2016). Nonmedical prescription opioid use and DSM-5 nonmedical prescription opioid use disorder in the United States. *Journal of Clinical Psychiatry*, 77, 772–780. <https://doi.org/10.4088/JCP.15m10386>
- SAMHSA (2013). *Results from the 2012 national survey on drug use and health: Summary of national findings*. Rockville, MD: Substances Abuse and Mental Health Services Administration.
- Satorra, A., & Bentler, P. M. (2001). A scaled difference chi-square test statistic for moment structure analysis. *Psychometrika*, 66, 507–514. <https://doi.org/10.1007/BF02296192>
- Sehgal, N., Manchikanti, L., & Smith, H. S. (2012). Prescription opioid abuse in chronic pain: A review of opioid abuse predictors and strategies to curb opioid abuse. *Pain Physician*, 15, ES67–ES92.
- Shei, A., Hirst, M., Kirson, N. Y., Enloe, C. J., Birnbaum, H. G., & Dunlop, W. C. N. (2015). Estimating the health care burden of prescription opioid abuse in five European countries. *ClinicoEconomics and Outcomes Research*, 7, 477–488. <https://doi.org/10.2147/CEOR>
- Simó Miñana, J. (2012). Utilización de medicamentos en España y en Europa. *Atencion Primaria*, 44, 335–347. <https://doi.org/10.1016/j.aprim.2011.06.009>
- Tompkins, D. A., Bigelow, G. E., Harrison, J. A., Johnson, R. E., Fudala, P. J., & Strain, E. C. (2009). Concurrent validation of the Clinical Opiate Withdrawal Scale (COWS) and single-item indices against the Clinical Institute Narcotic Assessment (CINA) opioid withdrawal instrument. *Drug and Alcohol Dependence*, 105, 154–159. <https://doi.org/10.1016/j.drugalcdep.2009.07.001>
- Vernon, M. K., Reinders, S., Mannix, S., Gullo, K., Gorodetzky, C. W., & Clinch, T. (2016). Psychometric evaluation of the 10-item Short Opiate Withdrawal Scale-Gossop (SOWS-Gossop) in patients undergoing opioid detoxification. *Addictive Behaviors*, 60, 109–116. <https://doi.org/10.1016/j.addbeh.2016.03.028>
- Von Korff, M. R. (2013). Long-term use of opioids for complex chronic pain. *Best Practice & Research Clinical Rheumatology*, 27, 663–672. <https://doi.org/10.1016/j.berh.2013.09.011>
- Wasan, A. D., Ross, E. L., Michna, E., Chibnik, L., Greenfield, S. F., Weiss, R. D., & Jamison, R. N. (2012). Craving of prescription opioids in patients with chronic pain: A longitudinal outcomes trial. *The Journal of Pain*, 13, 146–154. <https://doi.org/10.1016/j.jpain.2011.10.010>
- Weiss, R. D., Griffin, M. L., & Hufford, C. (1995). Craving in hospitalized cocaine abusers as a predictor of outcome. *American Journal of Drug and Alcohol Abuse*, 21, 289–301. <https://doi.org/10.3109/00952999509002698>
- Wheaton, B., Muthén, B., Alwin, D. F., & Summers, G. F. (1977). Assessing reliability and stability in panel models. In D. R. Heise (Ed.), *Sociological methodology* (pp. 84–136). San Francisco, CA: Jossey-Bass.
- Ziedonis, D. M., Amass, L., Steinberg, M., Woody, G., Krejci, J., Annon, J. J., ... Ling, W. (2009). Predictors of outcome for short-term medically supervised opioid withdrawal during a randomized, multicenter trial of buprenorphine-naloxone and clonidine in the NIDA clinical trials network drug and alcohol dependence. *Drug and Alcohol Dependence*, 99, 28–36. <https://doi.org/10.1016/j.drugalcdep.2008.06.016>

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