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PSYCHOLOGY, PSYCHIATRY & BRAIN NEUROSCIENCE SECTION

Predicting adherence and clinical response of cognitive behavioral therapy among individuals with chronic low back pain plus depressive symptoms: a secondary analysis of a randomized controlled trial

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Abstract

Background: Identifying predictors for adherence and clinical response to psychological therapies is essential for improving individual treatment outcomes.

Objective: To explore predictors of adherence and clinical response among individuals with co-occurring chronic low back pain (CLBP) and depression receiving cognitive behavioral therapy (CBT).

Methods: This study employs a secondary analysis of data from a randomized controlled trial (NCT04140838), including 156 individuals with CLBP plus depressive symptoms who received CBT. Multiple linear regression analyses were conducted to assess the predictive power of sociodemographic, health status, pain-related, and therapy-related variables on adherence and clinical response. Adherence was measured by therapy progress (number of completed sessions) and therapy completion (attendance at least 6 out of 8 sessions). Clinical response was assessed by a clinically relevant reduction in posttreatment pain interference.

Results: Older age, higher therapy credibility, and higher education level predicted greater therapy progress, while higher therapy credibility and lower baseline stress levels predicted greater therapy completion. In addition, higher opioid use, baseline pain interference, and baseline depression levels predicted lower clinical response; in contrast, higher behavioral activation levels, older age, and unemployment predicted higher clinical response.

Conclusion: Therapy credibility, age, and education level are key predictors of adherence, and baseline levels of pain interference, depression, and behavioral activation are key predictors of clinical response. These findings may inform opportunities to develop more effective personalized therapeutic plans for individuals with CLBP and depression.

Keywords: adherence; clinical response; cognitive behavioral therapy; chronic pain; depression.

Introduction

Chronic low back pain (CLBP), one of the leading causes of years lived with disability worldwide, is linked with substantial healthcare and societal costs.[1–3] This prevalent condition is also associated with significant psychological and functional impacts that compromise individual well-being.[4] CLBP often co-occurs with psychological conditions such as depression, anxiety, and general psychological distress.[5–8] Despite growing recognition of the adverse ramifications of this condition, treating individuals with CLBP and comorbid depressive symptoms remains particularly challenging, as they typically report more pain complaints, experience greater impairment, and show more treatment resistance compared to those with either condition alone.[9,10]

Previous research indicates that cognitive behavioral therapy (CBT) approaches are effective in managing CLBP.[11–14] Meta-analyses, for instance, suggest that traditional CBT-based interventions are beneficial for improving pain interference, quality of life, and depression in people with CLBP.[12,15,16] New forms of CBT, such as Acceptance and Commitment Therapy (ACT) and Behavioral Activation Therapy for Depression (BATD), have also been found to be effective and are recommended for treating CLBP with comorbid psychological symptoms.[17–20] Overall, the empirical evidence supporting the effectiveness of

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CBT-based therapies for chronic pain management is robust and well-supported by randomized controlled trials (RCTs).[17]

Therapy adherence and response, including substantial nonadherence and therapy failure, are well-known problems in psychological therapies.[21–23] A recent RCT found dropout rates of 34% for ACT and 45% for BATD among Spanish individuals with CLBP plus clinically relevant depressive symptoms at posttreatment, with ∼65% of participants in ACT and 45% in BATD responding positively to these therapies.[18] The 34% dropout rate for ACT in this RCT exceeds the 16% average reported in a meta-analysis of ACT across diverse settings and heterogeneous populations.[24] However, it falls within the 20%-40% range reported in a systematic review focused on online ACT interventions for chronic pain.[25] This rate could be influenced by factors such as sample characteristics (eg, baseline symptom severity and chronic pain comorbidities), treatment delivery, and disruptions caused by the COVID-19 pandemic.[19]

Meta-analyses highlight various key factors predicting reduced adherence and clinical response to CBT among treatment participants with chronic pain and comorbid psychological distress. For instance, recent findings suggest that low therapy credibility, elevated baseline depressive symptoms, and early delays in the therapeutic program were associated with reduced adherence.[26] These meta-analysis results are unsurprising as therapy credibility (ie, the individual's perception of how effective and logical the treatment is) and therapy expectancy (ie, the individual's belief in the likelihood of improvement and how convincing the therapy appears) have been identified as notable modifiable factors for enhancing adherence to CBT in chronic pain management in prior studies.[26–29]

Another recent meta-analysis has also identified several predictors of clinical response to CBT interventions for chronic pain, including demographic factors (eg, being women, younger age, being in a longer relationship, or work status), physical symptoms (eg, fatigue, pain tolerance, or the number of pain sites), and psychological variables (eg, baseline anxiety, depression, psychological distress, or catastrophizing).[30] However, to date, the predictors of adherence and clinical response in CBT-based interventions for individuals experiencing CLBP with clinically relevant depressive symptoms remain poorly understood. Therefore, this study leverages secondary analysis of RCT data to address this existing knowledge gap.

The main objective of the present study was to explore predictors of adherence and clinical response among individuals with co-occurring CLBP and depression receiving CBT. Identifying underlying factors that characterize those who fail to attend or complete CBT for pain (adherence) or who fail to respond to CBT (clinical response) can better inform and guide the development of tailored treatment methods for individuals with complex comorbidities. Furthermore, advancing the understanding of the predictors of CBT adherence and clinical response among this often-overlooked priority population could also improve the assignment of psychological therapies to individuals who are most likely to benefit from them.

Methods

Study design

This is a secondary data analysis of a 3-armed, multicenter, parallel RCT (NCT04140838) designed to determine the clinical efficacy, cost-utility, and physiological effects of ACT and BATD in individuals with comorbid CLBP and clinically relevant depressive symptoms.[18,31] This study was approved by the Ethics Committee of the Fundació Sant Joan de Déu (PIC-178-19) and the Hospital del Mar (2019/8866/I). Detailed information on this RCT is provided elsewhere by Sanabria-Mazo et al.[18,31,32]

Procedure and sample

Participants were recruited at the Pain Unit of the Parc Sanitari Sant Joan de Déu (Sant Boi de Llobregat) and Hospital del Mar (Barcelona) in Spain. As inclusion criteria, adults (aged 18-70 years) had to be diagnosed with CLBP (>3 months according to clinical history), present depressive symptoms (≥10 points out of 27 points according to the Patient Health Questionnaire-9),[33] have an electronic device (computer, tablet, or smartphone) with internet access, and understand Spanish. Participants were excluded if they presented cognitive impairment, had participated (in the last year) or were participating in psychological therapy, had diagnoses of severe psychiatric disorder or substance dependence/abuse, suffered from radiculopathy, were involved in litigation with the health system, or had scheduled surgery that made it impossible for them to attend group sessions.

A total of 234 participants met the eligibility criteria and were randomized to ACT ($n = 78$), BATD ($n = 78$), or treatment-as-usual ($n = 78$). Before obtaining informed consent and administering the battery of questionnaires, all these participants were informed about the study's purpose and the confidentiality agreements. The current study reports only the merged data from the 2 CBTs in this RCT ($n = 156$). These therapies (ie, ACT and BATD) were delivered in a group format and consisted of 8 weekly 1.5-hour sessions via videoconference. The protocols and specific content of these therapies are available in Sanabria-Mazo et al.[18] RCT data were collected at baseline, posttreatment (2 months after baseline), and follow-up (12 months after baseline). In total, 156 participants provided baseline data and 94 posttreatment data. Only baseline and posttreatment data were used for the analyses conducted in this study.

Outcome measures

Adherence to CBT

Therapeutic adherence was measured using 2 variables: (1) therapy progress and (2) therapy completion. Therapy progress was assessed by counting the number of completed sessions during the intervention (range 0-8 sessions). Instead, therapy completion was assessed by considering participants who attended 6 or more therapy sessions out of 8 (75% attendance) according to *per-protocol* analyses in the RCT.[18]

Clinical response to CBT

The primary outcome of the RCT was pain interference,[18] defined as the degree to which pain affects a person's ability to carry out daily activities, including social interactions and overall quality of life. It was measured using the Brief Pain Inventory-Interference Scale (BPI-IS). Based on the Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT) criteria for establishing clinically meaningful improvement in therapies,[34] participants who reported a one-point reduction in the pre-post pain interference mean score were considered to have positively responded to treatment and were labeled as "responders." In this study, clinical

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response to therapies represented an improvement in post-treatment pain interference scores.

Predictor variables

The selection of predictor variables related to CBT adherence and clinical response was informed by existing research evidence.[26,27,35] Specifically, they were grouped into 4 domains: (1) sociodemographic variables, (2) health status variables, (3) pain-related variables, and (4) therapy-related variables. Sociodemographic, health status, and pain-related variables were measured at the baseline interview of the study, while therapy-related variables were measured after the end of the first session of the psychological interventions. The description of each predictor variable is available in Table S1.

Sociodemographic variables

This domain comprised 5 variables: age, gender (women or men), marital status (single/separated/divorced/widowed or married/living with a partner), education level (primary education, secondary education, or university education), and employment status (unemployed or employed).

Health status variables

This domain consisted of 8 variables: days of sick leave (defined as the total number of days participants reported being on sick leave during the last 12 months, regardless of their employment status at the time of the baseline interview), years of diagnosis, analgesic medication (no or yes), anti-inflammatory medication (no or yes), opioid medication (no or yes), antidepressant medication (no or yes), anxiolytics medication (no or yes), and current episode of depression (no or yes) according to Composite International Diagnostic Interview (CIDI) criteria.[36]

Pain-related variables

This domain included 9 variables: pain interference (BPI-IS),[37] pain intensity (Numeric Rating Scale [NRS]), depression, anxiety, and stress (Depression Anxiety Stress Scales [DASS-21]),[38] pain catastrophizing (Pain Catastrophizing Scale [PCS]),[39] pain acceptance (Chronic Pain Acceptance Questionnaire [CPAQ-8]),[40] behavioral activation (Behavioral Activation for Depression Scale-Short Form [BADS-SF]),[41] and psychological inflexibility (Psychological Inflexibility in Pain Scale [PIPS]).[42] More information about the psychometric properties of these instruments in this sample can be found in Sanabria-Mazo et al.[18]

Therapy-related variables

This domain contained 5 variables: type of therapy (ACT or BATD), therapy credibility and therapy expectation (Credibility/Expectancy Questionnaire [CEQ]),[43] perceived technological knowledge, and perceived technological ability (both items measured by an ad hoc questionnaire based on the CEQ).

Data management and analysis

Due to limited statistical power to identify predictors, a preliminary analysis was conducted using bivariate regression to evaluate whether the type of therapy (ACT or BATD) predicted adherence or clinical response. This analysis did not reveal statistically significant differences between the 2 therapy groups in their effects on adherence or clinical response. In the absence of evidence supporting a differential impact, and to ensure sufficient statistical power for subsequent analyses, data from individuals receiving ACT and BATD were merged into a single psychological therapy group. This decision was further supported by the conceptual similarities between ACT and BATD, as both interventions aim to enhance psychological flexibility and behavioral activation.[18,44,45]

Initially, a descriptive analysis of the sample characteristics was performed using means (*M*) and standard deviations (SD), for continuous variables, and frequencies (*n*) and percentages (%), for categorical variables. As preliminary analyses, between-group differences in outcomes (ie, adherence and clinical response to therapies) and predictors (ie, sociodemographic, health status, pain-related, and therapy-related variables) were explored for "responders" (ie, participants who reported a one-point reduction in the pre-post pain interference total score) and "non-responders," as well as for "completers" (ie, participants who attended 6 of the 8 therapy sessions) and "non-completers." These differences were analyzed using the χ^2 test, for categorical variables, and Student's *t*, for continuous variables. A P value of .05 was considered the threshold for statistical significance.

Before conducting the main analysis, some examinations were conducted to screen for outliers and verify the assumptions of normality, linearity, multicollinearity, and homoscedasticity. No major violations were observed. Following the procedure of Gasslander et al,[26] bivariate regression analysis was used to identify candidate ($P < .10$) predictor variables for adherence (ie, therapy progress and therapy completion) and clinical response variable (ie, posttreatment pain interference scores). Predictor variables that fulfilled this criterion were included in the multiple linear regression analyses (for therapy progress and clinical response) and multiple logistic regression analyses (for therapy completion) by a backward elimination process for each outcome. R^2 was used to measure the proportion of the variance explained by the model in the multiple linear regression analyses and Nagelkerke R^2 in the multiple logistic regression analyses. In multiple linear regression, the tolerance and variance inflation factor (VIF) were also examined to detect multicollinearity issues among the predictor variables.

In addition, a sensitivity analysis using GPower v3.1 was conducted to indicate the effect size that could be detected by all models. To define the effect size of the linear regression models, the following parameters were used: Small ($f^2 = 0.02$), medium ($f^2 = 0.15$), and large ($f^2 = 0.35$); and for the logistic regression models: small (odds ratio [OR] = 1.44), medium (OR = 2.48), and large (OR = 4.27). Although the sample size was reduced to predict clinical response, from 156 to 94 participants (ie, those who were assessed at baseline and posttreatment), the sensitivity analysis retained sufficient statistical power to detect medium to large effect sizes in psychological interventions. All the analyses were conducted using the Statistical Package for the Social Sciences (SPSS, v26).

Results

Sample characteristics

Most of the 156 participants who underwent the CBT were women (69%), were married or lived with a partner (63%), had secondary education (56%), and were not working (67%) at the time of the interview. In addition, they had a mean of 104 days of sick leave (SD = 159.9) and reported around 11 years with a chronic pain diagnosis (SD = 8.2). More than 3-quarters of the sample were experiencing a

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current episode of depression according to CIDI criteria (79%) and nearly half used analgesic medication (42%). Regarding therapies, the mean number of completed sessions was 4.5 out of 8 (SD = 3.2). More information about the mean scores of pain-related variables and therapy-related variables is provided in Table 1.

Adherence to CBT

Baseline differences between completers and non-completers

Half of the sample ($n = 78$) were classified as completers (ie, attended at least 6 of the 8 therapy sessions). Participants who completed therapies were older ($M = 56.7$, SD = 8.3 vs $M = 53.1$, SD = 9.9, $P = .01$) and reported higher therapy credibility ($M = 23.7$, SD = 4.2 vs $M = 21.6$, SD = 6.1, $P = .04$) than those who did not complete therapies. Table S2 shows no significant baseline differences were found in other sociodemographic, health status, pain-related, and therapy-related variables between these 2 groups.

Predictors of therapy progress

Bivariate regression analysis identified 5 candidate predictor variables ($P < .10$) for therapy progress (ie, the number of completed sessions). Of these, 2 were sociodemographic variables (ie, age and primary education), 1 was a health status variable (ie, opioid medication), and 2 were therapy variables (ie, therapy credibility and therapy expectation). The bivariate regression analyses are explained in Table S3.

A multiple linear regression analysis using a backward elimination process initially included the aforementioned 5 candidate predictor variables. Finally, the model was composed of 3 predictor variables. According to the sample size ($n = 156$) and the initial number of predictors (5 variables), this analysis would be sensitive to the effects of $f^2 = 0.15$ (medium) with 97.3% power (alpha = 0.05, 2-tailed). As shown in Table 2, older age ($\beta = 0.21$, $P = .02$) and higher scores on credibility towards therapy ($\beta = 0.25$, $P = .01$) predicted greater therapy progress. Conversely, having only primary education ($\beta = -0.20$, $P = .03$) predicted lower therapy progress. This model explained 13% of the variance in therapy progress ($R^2 = 0.13$). Specifically, therapy credibility accounted for 5% of the variance, age for 4%, and primary education for 4%. The tolerance and VIF values suggested no significant multicollinearity issues among the predictor variables.

Predictors of therapy completion

Binary logistic regression analysis identified 5 candidate predictor variables ($P < .10$) for therapy completion (ie, attended a minimum of 6 of the 8 therapy sessions). Of these, 1 was a sociodemographic variable (ie, age), 1 was a health status variable (ie, opioid medication), 1 was a pain-related variable (ie, stress), and 2 were therapy-related variables (ie, therapy credibility and perceived technological ability). The binary logistic regression analyses are explained in Table S4.

A multiple logistic regression analysis using a backward Likelihood Ratio elimination process initially included the aforementioned 5 candidate predictor variables. Finally, the model was composed of 2 predictor variables. According to the sample size ($n = 156$) and the initial number of predictors (5 variables), this analysis would be sensitive to the effects of an odds ratio of 2.48 (medium effect size) with 98% power (alpha = 0.05, 2-tailed). As shown in Table 3, higher therapy credibility scores (OR = 1.10, $P = .02$) were associated with higher therapy completion rates. Conversely, higher stress scores (OR = 0.89, $P = .01$) were associated with lower therapy completion rates. This model explained

Table 1. Characteristics of the sample ($n = 156$).

	Total sample ($n = 156$)
Sociodemographic variables	
Age, *M* (SD)	54.9 (9.3)
Gender, *n* (%)	
Women	107 (68.6)
Men	49 (31.4)
Marital status, *n* (%)	
Single/separated/divorced/widowed	57 (36.5)
Married/living with a partner	99 (63.5)
Education level, *n* (%)	
Primary education	45 (28.9)
Secondary education	88 (56.4)
University education	23 (14.7)
Employment status, *n* (%)	
Unemployed	105 (67.3)
Employed	51 (32.7)
Health status variables	
Days of sick leave, *M* (SD)	104.2 (159.9)
Analgesic medication, *n* (%)	
No	92 (59)
Yes	64 (41)
Anti-inflammatory medication, *n* (%)	
No	123 (78.8)
Yes	33 (21.2)
Opioid medication, *n* (%)	
No	123 (78.8)
Yes	33 (21.2)
Antidepressants medication, *n* (%)	
No	113 (72.4)
Yes	43 (27.6)
Anxiolytics medication, *n* (%)	
No	133 (85.3)
Yes	23 (14.7)
Years of diagnosis, *M* (SD)	10.9 (8.2)
Current episode of depression, *n* (%)[a]	
No	33 (21.2)
Yes	123 (78.8)
Pain-related variables	
Pain interference (BPI-IS) (0-10), *M* (SD)	6.6 (1.9)
Pain intensity (NRS) (0-10), *M* (SD)	6.7 (1.7)
Depression (DASS-D) (0-21), *M* (SD)[b]	7.1 (5.3)
Anxiety (DASS-A) (0-21), *M* (SD)[b]	5.9 (4.2)
Stress (DASS-S) (0-21), *M* (SD)[b]	9.1 (5.1)
Pain catastrophizing (PCS) (0-52), *M* (SD)	24.5 (11.7)
Pain acceptance (CPAQ-8) (0-48), *M* (SD)	18.6 (7.1)
Behavioral activation (BADS-SF) (0-54), *M* (SD)	28.5 (9.6)
Psychological inflexibility (PIPS) (12-84), *M* (SD)	56.8 (16.1)
Therapy-related variables	
Type of therapy, *n* (%)	
ACT	78 (50)
BATD	78 (50)
Therapy credibility (CEQ) (0-30), *M* (SD)	23.1 (4.9)
Therapy expectation (CEQ) (0-30), *M* (SD)	23.5 (4.5)
Perceived technological knowledge (0-10), *M* (SD)	7.1 (2.4)
Perceived technological ability (0-10), *M* (SD)	8.2 (1.7)

Abbreviations: ACT, acceptance and commitment therapy; BATD, behavioral activation therapy for depression; BADS-SF, behavioral activation for depression scale (short form); BPI-IS, brief pain inventory-interference scale; CEQ, credibility/expectancy questionnaire.

[a] CIDI, composite international diagnostic interview; CPAQ-8, chronic pain acceptance questionnaire; DASS-21, depression anxiety stress scales; PCS, pain catastrophizing scale; NRS, numeric rating scale; PIPS, psychological inflexibility in pain scale.

[b] DASS-21 scores indicate moderate levels of depression, anxiety, and stress, as classified by the severity ratings outlined in the DASS-21 manual.

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Table 2. Predictor variables for the therapy progress ($n = 156$).

	B	SE B	β	t	P	Tolerance	VIF
Constant	−2.82	2.16					
Age	0.07	0.03	0.21	2.38	.02	0.98	1.02
Primary education (0 = no; 1 = yes)	−1.43	0.63	−0.20	−2.26	.03	0.96	1.04
Therapy credibility (CEQ)	0.16	0.06	0.25	2.85	.01	0.98	1.02

The dependent variable was the therapy progress (ie, the number of sessions completed).
Abbreviations: *B*, unstandardized beta values; SE *B*, standard error of B; *β*, standardized beta values; R^2, coefficient of determination; VIF, variance inflation factor; CEQ, credibility/expectancy questionnaire.

Table 3. Predictor variables for the therapy completion ($n = 156$).

	B	SE B	W	P	OR
Constant	−0.40	1.01			
Stress (DASS-S)	−0.11	0.04	7.01	.01	0.89
Therapy credibility (CEQ)	0.10	0.04	5.02	.02	1.10

The dependent variable was the therapy completion (ie, attended a minimum of 6 of the 8 therapy sessions).
Abbreviations: *B*, unstandardized beta values; SE *B*, standard error of B; *W*, Wald; OR, odds ratios; DASS-21, depression anxiety stress scales.

14% of the variance in therapy completion (Nagelkerke $R^2 = 0.14$).

Clinical response to CBT

Baseline differences between responders and non-responders

Of the 94 participants who were evaluated at baseline and posttreatment, more than half ($n = 54$) demonstrated a positive therapy response (ie, reported a one-point reduction in the pre-post BPI-IS mean score). At baseline, participants who responded positively were more likely unemployed (78% vs 52%, $P = .01$) and consumed fewer antidepressant medications (13% vs 35%, $P = .01$) than those who did not respond to therapies. They also had more days of sick leave ($M = 135.8$, SD = 184.1 vs $M = 65.3$, SD = 129.1, $P = .03$) and reported greater perceived technological ability ($M = 8.4$, SD = 1.3 vs $M = 7.4$, SD = 2.3, $P = .04$). Table S5 shows that no significant baseline differences were found in other sociodemographic, health status, pain-related, and therapy-related variables between these 2 groups.

Predictors of improvements in pain interference

Binary logistic regression analysis identified 14 candidate predictor variables ($P < .10$) for improvements in posttreatment pain interference scores. Of these, 2 were sociodemographic variables (ie, age and employment status), 4 were health status variables (ie, days of sick leave, opioid medication, antidepressant medication, and current episode of depression), and 8 were pain-related variables (ie, pain interference, pain intensity, depression, anxiety, pain catastrophizing, pain acceptance, behavioral activation, and psychological inflexibility). The binary logistic regression analyses are explained in Table S6.

A multiple linear regression analysis using a backward elimination process initially included the aforementioned 14 candidate predictor variables. Finally, the model was composed of 6 predictor variables. According to the sample size ($n = 94$) and the initial number of predictors (14 variables), this analysis would be sensitive to the effects of $f^2 = 0.35$ (large) with 96.1% power (alpha = 0.05, 2-tailed). As shown in Table 4, higher opioid consumption ($\beta = 0.84$, $P = .04$), higher baseline pain interference scores ($\beta = 0.39$, $P < .001$), and higher baseline depression scores ($\beta = 0.10$, $P = .02$) predicted higher posttreatment pain interference scores. Conversely, higher baseline behavioral activation scores ($\beta = -0.05$, $P = .04$) predicted lower posttreatment pain interference scores. Additionally, older participant age ($\beta = -0.05$, $P = .01$) and unemployment ($\beta = -0.81$, $P = .03$) predicted lower posttreatment pain interference scores. This model explained 57% of the variance in posttreatment pain interference scores ($R^2 = 0.57$). Specifically, baseline pain interference scores accounted for 37% of the variance, baseline depression scores for 11%, baseline behavioral activation for 3%, age for 2%, employment status for 2%, and opioid medication for 2%. The tolerance and VIF values suggested no significant multicollinearity issues among the predictor variables.

The results of a parsimonious model in which baseline pain interference is excluded are available in Table S7. This model, composed of 4 variables, explained 50% of the variance in posttreatment pain interference scores. Concretely, baseline depression scores accounted for 37% of the variance, pain acceptance for 8%, behavioral activation for 3%, and age for 2%. The tolerance and VIF values also suggested no significant multicollinearity issues among the predictor variables. In common, both models highlight the predictive role of baseline depression scores, baseline behavioral activation scores, and older participant age in clinical response.

Discussion

This research explored predictors of adherence and clinical response among individuals with co-occurring CLBP and depression receiving CBT. A key finding of this study is that older age, higher therapy credibility, higher education level, and lower baseline stress may be associated with therapy adherence. In this regard, these findings align with previous research indicating that age is a significant predictor of adherence and clinical response to psychological interventions, although the direction of this association remains unclear.[28] While the present study suggests better adherence among older individuals, previous studies have shown mixed results,[28] possibly due to differences in sample characteristics, intervention types, and required internet proficiency. Notably, the interventions in this study were professionally guided and required minimal technological skills.[29,46] This could explain why younger individuals in this study did not necessarily show higher adherence.

This study also found that therapy credibility was a significant predictor of adherence, aligning with prior study findings.[28] Specifically, in the present study, higher therapy credibility predicted better therapy progress and therapy completion. Assessing therapy credibility throughout the

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Table 4. Predictor variables for the improvements in pain interference ($n = 94$).

	B	SE *B*	β	*t*	*P*	Tolerance	VIF
Constant	5.69	1.56					
Age	−0.05	0.02	−0.18	−2.50	.01	0.90	1.11
Employment status (0 = unemployed; 1 = employed)	−0.81	0.37	−0.16	−2.17	.03	0.88	1.14
Opioid medication (0 = no; 1 = yes)	0.84	0.41	0.15	2.06	.04	0.97	1.03
Pain interference (BPI-IS)	0.39	0.11	0.32	3.65	<.001	0.66	1.51
Depression (DASS-D)	0.10	0.04	0.23	2.36	.02	0.55	1.80
Behavioral activation (BADS-SF)	−0.05	0.02	−0.19	−2.10	.04	0.56	1.77

The dependent variable was the improvements in pain interference.
Abbreviations: *B*, unstandardized beta values; SE *B*, standard error of *B*; β, standardized beta values; R^2, coefficient of determination; VIF, variance inflation factor; BADS-SF, behavioral activation for depression scale (short form); BPI-IS, brief pain inventory-interference scale; DASS-21, depression anxiety stress scales.

intervention could help detect any changes in credibility during the process, and, if a decrease in credibility is detected, it would be beneficial to evaluate underlying influences and adapt the intervention to the individual participant's needs participant. This could provide an important opportunity to intervene and enhance individuals' adherence to CBT.[47] Enhancing therapy credibility, especially when it is low, could lead to higher adherence rates, thereby improving the overall effectiveness of the therapy.[47,48] Since individuals' adherence to therapy is often challenging in psychological interventions, strategies to improve therapy credibility could be key in optimizing therapeutic outcomes.[46,47] Furthermore, directly addressing therapy credibility could empower individuals to engage more fully in their therapy, potentially leading to better long-term outcomes.

The results also indicated that having only primary education predicted less therapy progress, which could be due to less-educated individuals finding the therapy too demanding and not adhering to it.[28] Similarly, higher stress levels predicted reduced adherence in terms of therapy completion, which is consistent with previous studies indicating how distress and emotional symptoms impair therapy outcomes.[44] Low educational levels and high stress may suggest that these individuals are particularly vulnerable, highlighting the need for tailored clinical approaches or extra attention to avoid dropout or incompletion of the therapy.[49] Simplifying therapy protocols, integrating stress management techniques, and routinely assessing educational background and stress could enhance adherence and improve outcomes, especially in vulnerable populations.[49,50]

This study found a negative association between age and posttreatment pain interference, consistent with previous research identifying older age as a predictor of better clinical response.[35] Nonetheless, these findings contrast with a recent systematic review, which reported younger age as a predictor of clinical response to CBT for chronic pain.[30] This discrepancy suggests that while age is associated with clinical response, the direction of this association remains still unclear. Additionally, a significant age difference was found between completers and non-completers, with completers being older. Thus, the association between age and posttreatment pain interference could be facilitated by therapy completion.

In addition to age, baseline behavioral activation and unemployment predicted lower posttreatment pain interference (CBT clinical response), highlighting their protective roles in pain management. The observed negative association between employment status and posttreatment pain interference may reflect the challenges some employed participants faced in balancing work-related responsibilities with the physical and emotional demands associated with their pain. Future research could explore the integration of rehabilitation interventions with behavioral strategies aimed at enhancing coping mechanisms and work capacity, potentially mitigating the impact of occupational stressors on pain outcomes.[51]

Conversely, greater posttreatment pain interference was predicted by higher opioid use, higher baseline pain interference, and higher baseline depression, underscoring the need for careful management of these risk factors. The association between baseline pain interference and depression with worse outcomes suggests that individuals with higher initial distress may benefit from adapted interventions to achieve optimal results. Addressing these factors could significantly enhance the effectiveness of psychological interventions and improve long-term outcomes for chronic pain individuals.

Limitations

Some limitations of this study should be acknowledged. First, since this work is a secondary data analysis, no a priori power calculation was computed. However, a sensitivity analysis conducted with GPower indicated that the remaining sample size retained sufficient statistical power to detect medium-to-large effect sizes, which are typically observed in similar studies. Second, the relatively small sample size and high attrition rate may limit the generalizability of the findings to broader populations. To address this limitation, future studies might include larger and more culturally diverse samples, using stratified sampling approaches to enhance representativeness and cross-country comparisons. Additionally, combining secondary data analysis with prospective data collection could help validate the findings across different populations and contexts.

Third, due to the high dropout rate reported in the original study at 12 months,[18] it was not possible to replicate the analyses with the last follow-up evaluation. That is, it is not known whether the findings are sustained over time, which is especially important in the treatment of chronic conditions, such as CLBP and depression. To reduce attrition in future research, personalized engagement strategies, such as motivational interviewing and digital reminders, could improve adherence and participation. Finally, the study did not account for potential confounding variables, such as variations in participants' access to and familiarity with digital tools used for videoconferencing, which could have influenced the results. Given the increasing use of digital health

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interventions, evaluating digital literacy and access disparities is essential to ensure equitable participation in online psychological therapies, especially among populations with lower technological proficiency. In this regard, incorporating measures to assess digital literacy and technological accessibility in future studies would help better understand their impact on therapy adherence and clinical response.

Strengths

Despite these limitations, this research also has several strengths. First, the use of data from an RCT adds a level of rigor and reliability to the findings. Second, the inclusion of a diverse set of predictors (covering sociodemographic, health status, pain-related, and therapy-related variables) provides a comprehensive analysis of the factors influencing adherence and clinical response. Third, the study's focus on a population with comorbid CLBP and depressive symptoms addresses a significant gap in the literature, offering potentially valuable insights that could inform the development of more effective, personalized therapeutic interventions. Fourth, the study's design allows for the examination of both adherence and clinical outcomes, providing a holistic view of therapy impact. Finally, the use of videoconferencing for CBT delivery reflects the growing trend toward digital health solutions, making the findings particularly relevant in the context of increasing online healthcare delivery.

Implications of this study

Identifying predictors of adherence and clinical response to therapies for individuals with chronic pain and depression is important for several reasons. First, it can provide insights into how to better tailor CBT, ensuring that individuals receive more individualized therapies that may have a higher likelihood of being effective based on their characteristics. This could enhance the overall efficacy of the therapy and improve outcomes. Second, understanding these predictors can help identify individuals who might be at risk of non-adherence to CBT, allowing clinicians to implement targeted strategies to improve adherence. For example, in this study, younger individuals, those with only primary education, higher stress levels, and low therapy credibility, tended to show lower levels of adherence. This suggests that specific support measures could be beneficial in addressing these barriers. Third, certain baseline and demographic characteristics were associated with clinical response, which could be considered before therapy to potentially improve outcomes. By optimizing adherence, therapeutic benefits might be maximized, which could reduce the burden of chronic pain and depression on the healthcare system. Ultimately, these insights contribute to the success of psychological therapies for CLBP plus depressive symptoms, potentially leading to better management of chronic conditions and improved quality of life for individuals.

Conclusion

The findings presented here suggest that therapy credibility, age, and education level are key predictors of CBT adherence, and baseline levels of pain interference, depression, and behavioral activation are key predictors of clinical response. These factors deserve further clinical attention and study in people with chronic pain who might be offered CBT approaches. The findings revealed in this study underscore the importance of considering these variables in adapting therapies to foster adherence and optimize clinical outcomes.

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Author contributions

Juan P. Sanabria-Mazo: conceptualization, data curation, software, formal analysis, methodology, visualization, and writing the original draft. Estíbaliz Royuela-Colomer: conceptualization and writing the original draft. Jaime Navarrete, Carla Rodríguez-Freire, Brenda Robles, Lance M. McCracken, and Albert Feliu-Soler: writing—review & editing. Juan V. Luciano: conceptualization, funding acquisition, investigation, project administration, supervision, and writing—review & editing.

Supplementary material

Supplementary material is available at *Pain Medicine* online.

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Conflicts of interest: All authors declare no conflict of interest.

Data availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work, the authors used ChatGPT to improve some sentences of the manuscript in terms of grammar and style. After using this tool, the authors reviewed and edited the content as needed and took full responsibility for the publication's content.

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