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The Effects of Pre-treatment Depressive Symptoms on Quality of Life Across Cognitive Behavioral Therapy for Chronic Pain

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Abstract
Recent studies suggest that chronic pain affects millions and carries significant physical, financial, and social burdens, and thus adversely affects quality of life (QOL). Cognitive behavioral therapy for chronic pain (CBTp) is a non-pharmacological treatment method which has been shown to reduce a sufferer's experience of chronic pain and improve overall QOL. These and other studies also indicate that affective symptoms likely impact the effectiveness of CBTp. The current study focused on the effects of depressive symptoms on changes in QOL ratings across a 12-session CBT for chronic pain. Participants in this study ($n = 313$; mean age = 46.83 years, SD = 10.99, range = 19.1–79.9, 63.9% female, 83.9% Caucasian) were current patients of a mid-sized tertiary multidisciplinary outpatient chronic pain treatment facility. Progress through CBTp was assessed using QOL as a dependent variable and analyzed using RMANOVAs. All participants showed improvements in QOL ratings across the CBTp period, but greater improvements were seen in participants in the low depression category than in the high or moderate depression category. This study also confirms the clinical utility of the BDI-II with chronic pain patients.

Keywords Chronic pain · Depression · Quality of life · CBT · BDI-II

Introduction

Chronic pain can be defined as a subjective experience which lasts longer than 6 months with little or no relief from medical intervention, and which has a debilitating effect on the quality of life (QOL) and activities of daily living of the affected individual (de Figueiredo & Griffith, 2016; Ehde, Dillworth, & Turner, 2014; Jonsdottir, Aspelund, Jonsdottir, & Gunnarsdottir, 2014). A recent study (Inoue et al., 2015) suggests that chronic pain affects millions and carries significant physical, financial, and social burdens, thus adversely affecting QOL. Approximately 50% of chronic pain cases are comorbid with affective disorders such as depression, and the comorbidity of these two conditions often has an adverse effect on both QOL and treatment response (Kroenke et al., 2011). Depression often decreases both pain threshold tolerance and pain treatment success, thereby increasing subjective pain intensity, as well as patient dysfunction and disability (Manchikanti, Fellows, & Singh, 2002), and has been implicated in the transition from acute to chronic lower back pain (Shaw et al., 2010). Gerrits, van Marwijk, van Oppen, van der Horst, and Penninx (2015) report that depressive disorders are associated with increased pain severity, higher number of pain locations, and longer time to pain remission both prior to and after the remission of depressive symptoms as compared to mentally healthy controls. In addition to this evidence, a further study of the effects of depression on QOL in breast cancer survivors (Kim et al., 2018) effectively demonstrate that an increase in depressive symptoms negatively impacts QOL. This body of literature clearly suggests that both chronic pain and depressive symptoms may lead to decreases in QOL.

One commonly used method of assessing the effects of chronic pain treatment is measuring changes in QOL over the course of the treatment period (Inoue et al., 2015; Jonsdottir et al., 2014). QOL is a complex concept, encompassing aspects of life such as physical, psychological, and social well-being and financial stability (Kapuria, 2016), cognitive and emotional life evaluations (Stewart, Reynolds, Jones, Stewart, & Nelson, 2016), and an individual's perception of their position

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in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns (The WHOQOL Group, 1998). QOL can be affected by chronic pain as a result of mobility limitations (Stubbs, Schofield, & Patchay, 2016), depression and anxiety (Inoue et al.), and pain frequency, pattern, and intensity (Jonsdottir et al.). Therefore, QOL effectively demonstrates changes resulting from chronic pain intervention.

Given the relationship between depression and chronic pain, it can be easily understood that affective symptoms often impede progress in medical pain management. One APA-approved non-medical intervention for chronic pain is cognitive behavioral therapy for chronic pain (CBTp). Cognitive behavioral therapy works on the premise that faulty cognitive processes cause distorted interpretations of reality, thereby compromising the biopsychosocial health of the patient (Castro, Daltro, Kraychete, & Lopes, 2012; Ehde et al., 2014; Thorn, 2004). CBTp is designed to remedy those faulty cognitive processes by helping patients identify maladaptive thoughts, attitudes, beliefs, and behaviors which can skew the experience of pain (Castro et al.). Thus, in addition to the improved outcomes in chronic pain patients whose symptoms are not relieved by medication alone, the addition of psychological intervention may also improve treatment results in patients who do experience significant relief through medical intervention, thereby improving overall patient outcome, and reducing the need for higher doses of pain management medication.

Available literature presented above effectively demonstrates that depression can have an adverse effect on chronic pain, and that both depression and chronic pain can have adverse effects on QOL. Despite this support, an extensive search of available literature found that research examining the effects of depression on changes in QOL across CBTp was limited. The current study aimed to support previous studies which demonstrate the clinical utility of CBTp, such as Castro et al. (2012), and expand those studies by examining the effects of depressive symptoms on changes in QOL across the CBTp period. First, it was proposed that chronic pain patients would demonstrate an improvement in QOL scores in each domain over the course of a 12-session group CBTp program regardless of depression symptoms. Thus, we predicted a significant within-subjects main effect for CBTp. Second, it was proposed that QOL ratings across the CBTp period would be differentiated based on depressive symptoms. Thus, we predicted a significant between-subjects main effect for depression category.

Method

Participants

Participants ($n = 313$) were chronic pain patients undergoing outpatient group CBTp at a mid-sized tertiary multidisciplinary pain management facility in Huntsville, AL. The sample was 63.9% female and 83.7% Caucasian. Mean age was 46.83 years (SD = 10.99; range 19.1–79.9). The most common of the 13 reported primary pain locations was lower back (46.6%), followed by multiple pain sites (20.8%), and all other pain sites being reported by less than 10% of all participants. Of the 313 participants, 70 participants had at least one medication change during the CBTp period. Also, of the 313 participants, 2 participants repeated one or more sessions while still attending each of the 12 unique sessions, and 1 participant was allowed to skip the second-to-last session of CBTp. The remaining 310 participants completed exactly 12 unique sessions of CBTp. Consent was obtained from all participants with no incentives for participating and no ramifications for opting out. All HIPAA, APA, AMA, and human subjects standards were followed. Descriptive statistics are available in Table 1.

Design

The purpose of this study was to examine the effects of pre-CBTp depression ratings on changes in QOL ratings across a 12-session group CBTp. This study employed a 4×3 (QOL domain × depression category) factorial repeated measures design. The first factor, QOL, included four levels, which are the psychological, social, environmental, and physical domains of QOL, as assessed using the World Health Organization Quality of Life Scale, Brief (WHOQOL). QOL was assessed four times across the CBTp period, resulting in the repeated measures design. The second factor was depression category. Depression category was determined using the Beck Depression Inventory-II (BDI-II) and the Depression scale from the Millon Behavioral Medicine Diagnostic (MBMD). The dependent variable was the change in QOL ratings from the initial to final session of CBTp.

Although this study involved chronic pain patients, chronic pain itself was not a construct of interest for this particular study. Overall pain ratings were collected along with WHOQOL data but were not analyzed in the primary data analysis for several reasons. First, changes in pain ratings were not a construct of interest of this study. The focus of this study was to examine the role of depressive symptoms specifically on changes in QOL in response to

Table 1 Descriptive statistics

Category	Frequency	%
Female	200	63.9
Male	113	36.1
African-American	50	16.0
Caucasian	262	83.7
Other ethnicity	1	0.3
Low back pain	146	46.6
Multiple pain sites	65	20.8
All other pain sites	102	32.6
Pain rating	*M*	SD
Initial	6.09	1.86
Final	5.45	1.92

CBTp. The clinical utility of CBTp at reducing pain ratings has been previously established (Castro et al., 2012; Ehde et al., 2014). Second, pain ratings are inherently subjective. Pain ratings may fluctuate based on experiences, mood, fatigue, or time of day (Bartley, Robinson, & Staud, 2017; Schneider et al., 2012; Tupper, Rosenberg, Pahwa, & Stinson, 2013), and one study found that pain ratings may vary based on having one's arms crossed or placed at one's side (Valentini, Koch, & Aglioti, 2015), or even simply by seeing oneself in a mirror (Longo, Betti, Aglioti, & Haggard, 2009). Third, due to the subjective nature of pain ratings, there is an undeniable and unacceptable amount of variation in pain ratings (Li, Liu, & Herr, 2007). Fourth, a greater degree of pain rating variation has been found in patients with depressive symptoms than in those without those symptoms (Zakoscielna & Parmelee, 2013). Finally, in a study of pain variability in two separate samples of patients with a chronic painful disease, Schneider et al. found that day-to-day fluctuations in pain ratings averaged 13% in one sample and 17% in the other. Per the IMMPACT report by Dworkin et al. (2008), pain rating changes between 10 and 30% are considered 'minimally significant.' This creates an inherent discrepancy in the study of pain ratings. Therefore, the decision was made to forego the direct examination of pain rating data and to only examine the larger construct of overall QOL.

Materials

The World Health Organization Quality of Life Scale, brief (WHOQOL) is a 26-question instrument designed to assess the physical (seven questions; Chronbach's $\alpha = 0.82$), psychological (six questions; Chronbach's $\alpha = 0.81$), social (three questions; Chronbach's $\alpha = 0.68$), and environmental (eight questions; Chronbach's $\alpha = 0.80$) domains of QOL (Shawver et al., 2016; Skevington, Lofty, & O'Connell, 2004). The WHOQOL has been examined extensively for discriminant validity between medical populations and healthy controls with significant results in all four domains of QOL at the $\alpha = 0.01$ level. The instrument was developed by the World Health Organization using a cross-sectional design, assessing its psychometric properties with over 10,000 participants in 23 countries across all populated continents, resulting in an instrument that accurately measures the physical, psychological, social, and environmental domains of QOL. Scores range from 0 to 100.

The BDI-II is a 21-item self-rating questionnaire, with four statements on each item rated between 0 (least depressive symptoms) to 3 (most depressive symptoms) over the last 2 weeks (Kjaergaard, Arfwedson-Wang, Waterloo, & Jorde, 2014). The BDI-II reports scores in four categories: 0–13 (minimal symptoms), 14–19 (mild symptoms), 20–28 (moderate symptoms), and 29+ (severe symptoms). The BDI-II has been shown to be a highly reliable instrument, both in healthcare and other clinical settings, with confidence levels between 0.86 and 0.96 (Jakšić, Ivezić, Jokić-Begić, Surányi, & Stojanović-Špehar, 2013).

Although published reliability and validity are high for both medical patients and healthy controls, available literature suggests that BDI-II scores may be artificially inflated in chronic pain patients as a result of elevated responses to questions regarding somatic symptoms of depression (Poole, White, Blake, Murphy, & Bramwell, 2009). Thus, the depression scale from the MBMD was also administered as a control for comparison. The MBMD is a self-report questionnaire composed of 165 items which load onto 38 scales designed to accurately identify psychological issues and recommend specific interventions in medical patients (Wise & Streiner, 2010) by assessing psychological symptoms which are not directly attributable to physical symptoms such as pain. Scores are reported on a ratio scale from 0 to 115. Internal consistency varies across scales, with

Chronbach's α ranging from 0.54 to 0.89. Test–retest reliability also varied across scales, with r^2 ranging from 0.71 to 0.92. Scores from the depression scale of the MBMD were categorized using *t*-score clinical markers, resulting in categories of 0–34 (low), 35–74 (moderate), and 75+ (high). All data were collected by trained staff at the host facility and maintained in electronic medical records. All HIPAA, APA, AMA, and human subjects guidelines were followed.

Procedure

Data collection for this study has been ongoing since October 2014. Informed consent was obtained from all individual participants with no ramifications for either participating or declining to participate. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Participants engaged in CBTp in accordance with prescribed standards (Thorn, 2004). The CBTp program consisted of an initial intake session, at which time participants completed the first WHOQOL, and 12 group-CBTp content sessions, with individual feedback sessions and WHOQOL assessments after every fourth group-CBTp session. This assessment frequency of one assessment every four sessions was established in order to track changes in QOL across the CBTp period at regular intervals without inducing reactivity or becoming an encumbrance to participants by assessing QOL more frequently. Participants completed the BDI-II, MBMD, and several other instruments not relevant to this study as a matter of practice procedure no later than the second assessment of QOL following the fourth session of CBTp. Testing was administered by and completed in the office of a licensed practicing psychologist on staff at the host facility. This staff psychologist was not involved in providing CBTp to avoid any bias or conflicts of interest.

Statistics

After all data had been entered into electronic medical records by facility staff, data were then collected by a trained researcher and entered into an excel spreadsheet kept on a password-protected computer in a locked room. After removing any personal identifiers, data were analyzed via SPSS using four repeated measures ANOVAs (RMANOVA, one for each domain of QOL) for both the BDI-II and the MBMD depression scale, resulting in 8 RMANOVAs, to assess main effects and interactions in QOL in relation to assessment and depression category. For each RMANOVA, one domain of the WHOQOL at each assessment was the dependent variable and depression category was the between-subjects factor. Alpha level was set at 0.05.

All participants in this study were under the care of a medical doctor specialized in chronic pain treatment. For the duration of this study, participants' individual plans of care remained in effect without alteration due to this study. Individual plans of care are routinely modified by the treating physician for medical reasons, and this process was the same for participants in this study as for non-participant patients. Routine modification of plans of care is common before the first feedback session following the fourth session of CBTp. By the first feedback session, participants have been in multidisciplinary pain management for approximately 2 months ($M = 59.9$ days, SD = 33.59 days), and at that point plans of care have typically been titrated to maximum effect for the patient. In the current data, $n = 70$ participants had at least one medication change after the first feedback session and $n = 243$ did not have a medication change after the first feedback session for the duration of the study. The modal number of medication changes after the first feedback for this subgroup of $n = 70$ participants was one change ($n = 49$), with only 5.7% ($n = 4$) with four or more changes in medication during the study period. To determine if medication changes contributed to progress in CBTp, we conducted one RMANOVA per domain of QOL (resulting in four RMANOVAs) with medication change (yes or no) after the first feedback session as the between-subjects variable. Medication change was not significant in either of the four domains of QOL using either depression assessment instrument. We then included the number of medication changes as a covariate and achieved the same results. In the current data, medication change is not a significant factor in progress across the CBTp period as measured by QOL.

Participants were encouraged to attend CBTp sessions on a weekly basis; however, as several participants suffered from limited mobility and relied on friends and family members for transportation and financial support, and as a result of scheduling limitations imposed by some insurance providers, participants attended CBTp as scheduling allowed for all parties involved. Due to the fluid nature of the week-to-week participation in CBTp resulting from insurance requirements and circumstances specific to the individual participant, time to completion was different for each participant. Although the mean time to completion was 24.16 weeks, the range of completion times was 12–85 weeks.

Given this wide range in time to completion, preliminary data analysis was conducted to determine if time to completion significantly affected our analyses. RMANOVAs were conducted as stated with the exception of adding time to completion in weeks as a covariate. The results demonstrated no significant interaction between QOL domain or depression category and time to completion. Further analyses were conducted which included participants whose time to completion was within 1.5 SD of the mean time to completion (12–36 weeks). The lack of significant interaction

Table 2 Overall means by depression category

Category	*n*	Range	Mean	SD
BDI-II[a]				
Low	112	0–13	7.35	3.81
Mild	56	14–19	16.39	1.55
Moderate	68	20–28	23.93	2.82
High	77	29–62	38.65	6.62
MBMD Dep.[b]				
Low	75	0–34	14.73	6.41
Moderate	109	35–74	61.02	10.44
High	129	75–115	88.50	10.87

[a]Beck Depression Inventory-II

[b]Millon Behavioral Medicine Diagnostic Depression Scale

between either factor and time to completion persisted, and the effect sizes of those RMANOVAs were approximately 0.10 larger than in the RMANOVAs which included all 313 participants. As the results were more conservative, the decision was made to retain all 313 participants. This decision was made due to the nature of clinical practice that the practitioner or researcher cannot control patient-specific circumstances and insurance requirements which affect time to completion. Thus, the decision was made to examine the mean of all participants, rather than only those who complete CBTp within a specified time frame. Time to completion was also examined using a Pearson's Correlation with both the BDI-II ratings and the MBMD depression ratings as a measure of the relationship between depression and treatment engagement. The correlation between time to completion and depression was $r = .07$ using either measurement of depression, indicating virtually no relationship between depression and treatment engagement.

Results

In all instances, significant improvement was observed in QOL ratings across the CBTp period regardless of depression category or depression assessment instrument. Overall group means for depression are reported in Table 2. The psychological domain demonstrated a significant main effect using both the BDI-II, $F(3, 927) = 86.72$, $MSE = 101.79$, $p < .001$, $\eta_p^2 = 0.22$, and the depression scale of the MBMD, $F(3, 930) = 66.51$, $MSE = 109.41$, $p < .001$, $\eta_p^2 = 0.18$. Depression category also produced a significant between-subjects main effect for all depression categories across all domains of QOL regardless of depression assessment instrument. The psychological domain demonstrated a significant main effect using both the BDI-II, $F(3, 309) = 103.38$, $MSE = 149.83$, $p < .001$, $\eta_p^2 = 0.50$, as well as the depression scale of the MBMD, $F(2, 310) = 87.19$, $MSE = 191.58$, $p < .001$, $\eta_p^2 = 0.36$. Similar within-subjects and between-subjects effects were seen in the social, environmental, and physical domains, presented in Table 3 (within-subjects) and Table 4 (between-subjects). Post hoc Bonferroni procedures were used to assess a priori between-subjects effects and are reported in Table 5 (MBMD) and Table 6 (BDI-II). Comparison of QOL means for each category of depression in each domain at each assessment is demonstrated in Fig. 1 (BDI-II) and Fig. 2 (MBMD depression scale). These results clearly support Hypothesis 1, that QOL ratings will increase

Table 3 Within-subjects effects by QOL domain

Domain	Dep. instrument	*F*	df	MSE	η_p^2
Psychological	MBMD	66.51	3	109.41	0.18
	BDI-II	86.72	3	101.79	0.30
Social	MBMD	29.33	3	177.83	0.09
	BDI-II	37.18	3	171.58	0.11
Environmental	MBMD	61.37	3	76.64	0.17
	BDI-II	75.38	3	74.62	0.20
Physical	MBMD	190.38	3	102.97	0.38
	BDI-II	198.84	3	101.11	0.39

Effects were significant at the 0.05 alpha level

Table 4 Between-subjects effects by depression instrument

Instrument	QOL domain	*F*	df	MSE	η_p^2
MBMD	Psychological	87.20	2	191.52	0.36
	Social	47.14	2	296.78	0.23
	Environmental	36.31	2	166.62	0.19
	Physical	41.63	2	174.13	0.21
BDI-II	Psychological	40.38	3	149.84	0.50
	Social	51.81	3	258.35	0.34
	Environmental	37.76	3	150.98	0.27
	Physical	51.02	3	148.20	0.33

Effects were significant at the 0.05 alpha level

Table 5 Post hoc between-subjects difference between MBMD depression categories

QOL domain	Dep. Cat.	df	MD	SE	r^2
Psychological	Low–Mod	184	11.73	2.08	.15
	Mod.–Hi	238	14.19	1.80	.21
Social	Low–Mod	184	11.40	2.58	.10
	Mod.–Hi	238	12.47	2.24	.12
Environmental	Low–Mod	184	7.94	1.94	.08
	Mod.–Hi	238	7.83	1.68	.08
Physical	Low–Mod	184	5.65	1.98	.04
	Mod.–Hi	238	10.83	1.72	.14

Effects were significant at the 0.05 alpha level

Table 6 Post hoc between-subjects difference between BDI-II depression categories

QOL domain	Dep. Cat.	df	MD	SE	r^2
Psychological	Low–Mild	168	9.46	2.00	.12
	Mild–Mod	124	6.51	2.21	.07
	Mod.–Hi	145	15.49	2.04	.28
Social	Low–Mild	168	8.97	2.63	.06
	Mild–Mod	124	8.87	2.90	.07
	Mod.–Hi	145	10.78	2.67	.10
Environmental	Low–Mild	168	7.22	2.01	.07
	Mild–Mod	124	4.91	2.22	.04
	Mod.–Hi	145	6.58	2.04	.07
Physical	Low–Mild	168	10.06	1.99	.16
	Mild–Mod	124	4.56	2.20	.03
	Mod.–Hi	145	6.81	2.03	.07

Effects were significant at the 0.05 alpha level

significantly between initial and final assessment regardless of depression category, as well as Hypothesis 2, that QOL ratings across the CBTp period could be differentiated by depression category.

Significant interactions were found in all domains of QOL when depression category was assessed using the BDI-II, but not when using the MBMD depression scale, psychological domain × BDI-II, $F(9, 927) = 8.41$, MSE = 101.79, $p < .001$, $\eta_p^2 = 0.08$, psychological domain × MBMD depression scale, $F(6, 930) = 0.476$, MSE = 109.41, $p =$ NS. Similar interactions were seen in the other three domains of QOL, presented in Table 7. The MBMD depression scale assesses depression without regard to a chronic medical condition by purposefully omitting questions related to the physical aspects of depression. Thus, the MBMD depression scale is less likely than the BDI-II to share variance with the effects of CBTp, making the lack of interaction between QOL domain and the MBMD depression scale unsurprising. The significant interactions observed between QOL domain and the BDI-II demonstrate the interplay between improvements in relation to CBTp and improvements in relation to medical treatment.

Separate RMANOVAs were conducted to determine the role of medication change in increases in QOL across the CBTp period. One RMANOVA was conducted for each domain of QOL with medication change as a between-subjects factor. Medication change was not significant in either the psychological, $F(3, 933) = 0.06$, MSE = 109.37, $p = .982$, social, $F(3, 933) = 1.01$, MSE = 177.77, $p = .389$, environmental, $F(3, 933) = 0.10$, MSE = 114.18, $p = .757$, or physical, $F(3, 933) = 0.10$, MSE = 103.93, $p = .961$, domains.

Discussion

Available literature presented above effectively demonstrates that depression can have an adverse effect on chronic pain, and that chronic pain can be effectively treated using CBT. Despite this support, an extensive

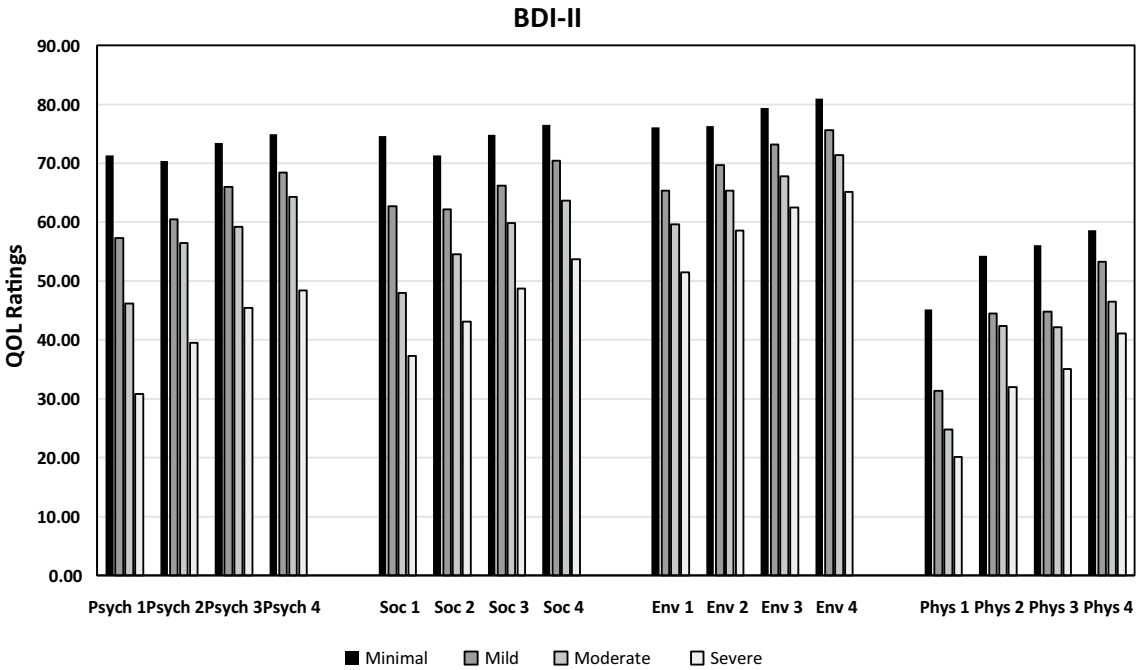

Fig. 1 Pre-CBTp depression ratings assessed by the BDI-II differentiate increases in QOL ratings across the CBTp period

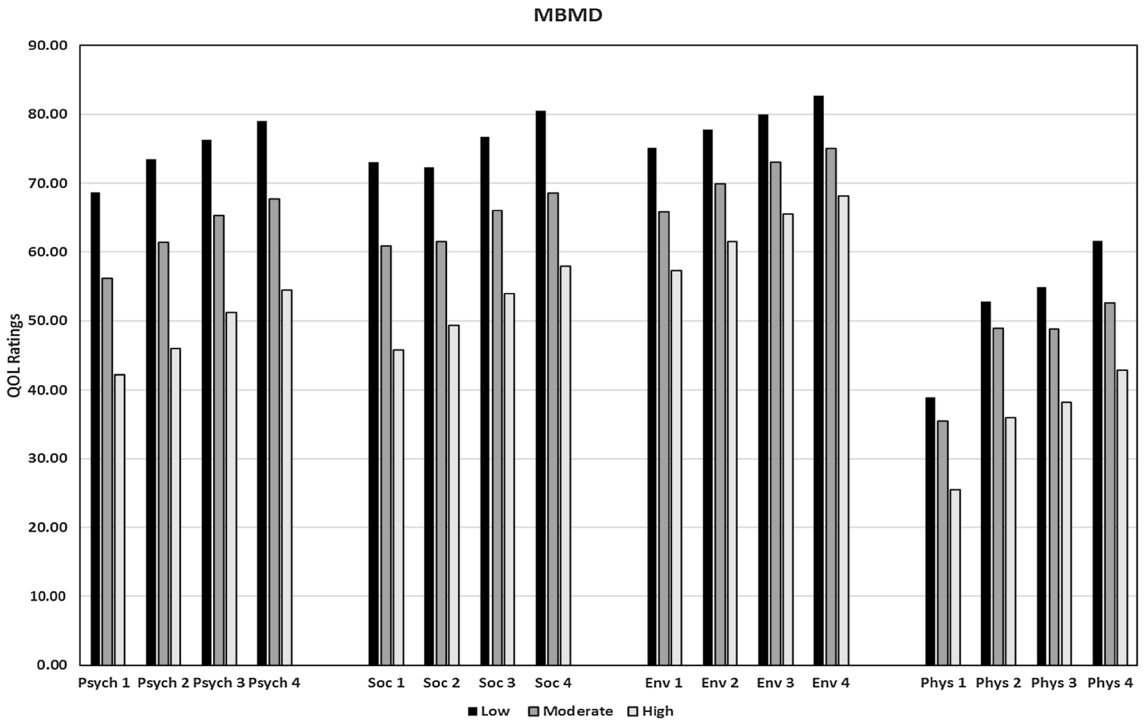

Fig. 2 Pre-CBTp depression ratings assessed by the MBMD differentiate increases in QOL ratings across the CBTp period

Table 7 QOL × BDI-II interactions by QOL domain

Domain	*F*	df	MSE	η_p^2
Psychological	8.41	9	101.79	0.08
Social	4.75	9	171.58	0.04
Environmental	3.76	9	74.62	0.04
Physical	3.60	9	101.11	0.03

Effects were significant at the 0.05 alpha level

search of available literature found that research examining the effects of depression on changes in QOL across CBTp was limited. The results of the present study clearly demonstrate the deleterious effects of pre-treatment depression on changes in QOL across the CBTp period. Hypothesis 1 predicted a significant within-subjects main effect for CBTp similar to that reported by Castro et al. (2012), among others. Significant within-subjects main effects are seen in all four domains of QOL, suggesting that, regardless of depression category, CBTp significantly improves overall QOL for chronic pain patients. Robust effect sizes were observed in the physical domain, and smaller yet meaningful effect sizes were obtained in all other domains, suggesting that the benefits of CBTp are more salient in the physical domain. This is unsurprising, as the benefits of medical intervention and CBTp are directly assessed in the physical domain of QOL. The modest effect sizes associated with the other three domains could be a result of interactions with other moderating variables (Ehde et al., 2014).

The results of the present study also clearly demonstrate a significant between-subjects main effect for depression category. Hypothesis 2 predicted a significant between-subjects main effect for depression as a result of the documented relationship between depression and QOL, as demonstrated in a plethora of available literature (Kroenke et al., 2011; Kim et al., 2018). In each domain, participants in the low depression category showed the highest QOL scores at each assessment and participants in the high depression category showed the lowest QOL scores, indicating that QOL is inversely related to depression. Robust effect sizes were found in all domains of QOL, indicating that depression category, as assessed using pre-CBTp BDI-II and MBMD depression scores, significantly impacts overall patient outcome. Post hoc analysis of these between-subjects assessments using Bonferroni procedures also clearly demonstrates a significant difference in mean QOL scores for each depression category in each domain of QOL, thus lending further evidence of the impact of depression on patient outcomes. These findings expand the current scope of the research by combining research into the benefits of CBTp with research into the deleterious effect of depressive symptoms, resulting in evidence that depressive symptoms hinder improvements in QOL resulting from CBTp.

The obvious clinical implication is that CBTp can positively impact QOL in chronic pain patients. The inclusion

of CBTp can result in decreased pain ratings when used either in conjunction with standard medical pain management or as a standalone therapy. Therefore, CBTp should be considered a viable addition to any medical treatment for chronic pain. Similarly, this study also found that depression ratings as assessed by the MBMD depression scale and the BDI-II significantly influence patient outcomes resulting from the effects of CBTp as determined by QOL measurement. Thus, practitioners may consider referring participants high in depressive symptoms for individual therapy before including the participant in CBTp. Individual counseling may reduce depression symptoms, and, in effect, move the participant from the High to the Moderate category, thus improving overall patient outcome. Alternatively, CBTp could be altered to include elements related specifically to depression, potentially alleviating both conditions simultaneously. The combination of CBTp with aspects which address depression is a topic which should be considered for future research.

An interesting secondary outcome of this study was observed in relation to the clinical utility of the BDI-II in a chronic pain setting. Poole et al. (2009) conducted a study which compared the results of the BDI-II against findings from Structured Clinical Interview for DSM-IV (SCID). The results suggested that the BDI-II may overestimate the prevalence of depressive symptoms in chronic pain patients. The authors explain that the SCID is the gold standard for assessing depressive symptoms in this population, and acknowledge the BDI-II as a useful instrument only when used as a screener for this population. The results of the current study show that depressive symptoms in chronic pain patients can be adequately measured by the BDI-II. The MBMD depression scale has been validated for use in assessment of chronic pain patients. Statistical analysis revealed only slight differences in depression ratings from the BDI-II and the MBMD, and thus confirm the BDI-II as a valid and useful tool in assessing depression in chronic pain patients.

While there are limitations to this study, the results suggest several avenues for future research. One limitation to this study concerns the time constraint of the study. Future researchers could conduct follow-up studies to examine the effects of CBTp beyond the CBTp period (Scott, Hann, & McCracken, 2016). A further aspect that this study did not assess was changes in depression as a result of CBTp. Future research could examine depression ratings pre- and post-CBTp to examine the effects of CBTp on depression, as well as the converse. Future research could also examine other potential moderators of QOL change resulting from the effects of CBTp, such as multiple pain sites, non-specific physical problems, rumination, and catastrophizing (Ehde et al., 2014). Such studies may lead to the refinement of theoretical models and the development of more effective therapies. Further limitations involve the composition of the subject pool. Although our sample did include participants from both urban and rural settings, as well as participants with a range of backgrounds, including farming, construction, military, food service, teaching, and professional careers (i.e., engineering, accounting), our sample is comprised primarily of Caucasian female participants from the southeastern United States. Thus, this study does not consider regional, cultural, or ethnic differences in depression or QOL.

One further area of future research presents itself as a natural progression from the current study. The current study found a significant relationship between pre-CBTp depression ratings and post-CBTp QOL ratings. Given the time differences in depression ratings and QOL ratings, the question of predictive validity presents itself. Future research could examine the relationship between depression and QOL using regression analyses to determine the predictive validity of the BDI-II and the MBMD depression scale on post-CBTp QOL scores.

In summation, depressive symptoms were found to significantly impact patient outcomes in CBTp as determined by QOL ratings. Final QOL ratings clearly demonstrated the impact of pre-CBTp depression ratings on patient improvement in CBTp using both the modified and standard interpretations of the BDI-II and the depression scale from the MBMD. Regardless of depression category, all participants showed improvements in QOL ratings across the CBTp period, but greater improvements were seen in participants in the low depression category than in the high or moderate depression category. This study also confirms the clinical utility of the BDI-II with chronic pain patients. Clinical implications suggest that chronic pain patients can benefit from CBTp regardless of depressive symptoms, but that participants rated in the moderate or severe categories of the BDI-II may experience a greater benefit if CBT is either modified to include aspects pertinent to depression or delayed until depressive symptoms have subsided.

Compliance with Ethical Standards

Conflict of interest Justin M. Hughes is a Master's Candidate at The University of Alabama in Huntsville. Eric A. Seemann is a tenured Associate Professor at The University of Alabama in Huntsville and Director of Research at Covenant Pain Therapies Center. J. Michael George is the Director of Behavioral Sciences at Covenant Pain Therapies Center. K. Dean Willis is the Clinic Director at Covenant Pain Therapies Center.

Human and Animal Rights All procedures were in accordance with the ethical standards of the institutional research committees and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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