Predictors of Response and Remission From Depression at 6-months of Treatment Within an Integrated Care Program

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Abstract

Background: Increased understanding of patient- and system-level factors associated with depression treatment outcomes could help guide the delivery and design of behavioral health services within primary care settings.

Methods: Using routine behavioral health screening and EHR data, we identified a sample of 615 adult patients receiving depression treatment within an integrated care program. Patient Health Questionnaire (PHQ-9) data was analyzed for the 6 months following initiation of treatment. Multinomial regression models were estimated to identify factors associated with depression treatment response (PHQ-9 < 10) and remission (PHQ-9 < 5).

Results: At 6 months, 47% and 16% of patients demonstrated response and remission, respectively. Baseline trauma symptoms and suicidal ideation were significantly associated with decreased odds of achieving remission (Odds Ratio [OR] = 0.45 (0.23, 0.88) and OR = 0.49 (0.29, 0.82), respectively). In fully adjusted models, baseline suicidal ideation remained significant (OR = 0.53 (0.31, 0.89)).

Conclusions: Routine screening for depression and trauma symptoms at baseline should be considered when designing depression treatment services in real-world settings. After controlling for baseline depression symptoms, the presence of suicidal ideation predicts reduced likelihood of remission.

Background

Depression is common, with 17.3 million adults within the United States (U.S.), or 7.1% of the population, experiencing an episode of depression yearly [1]. Depression causes significant morbidity, which impacts mental health, overall general health outcomes, everyday functioning [1-4] and quality of life [4]. Depression is associated with medically unexplained physical symptoms such as pain and fatigue [5-6], and poorer prognosis of chronic medical conditions such as diabetes, asthma, and hypertension [2,7]. Sadly, depression is the leading cause of suicide [8]. Furthermore, depression has a significant impact on the U.S. economy in terms of decreased work productivity, direct medical costs [9], and suicide-related mortality costs [3].

Given the burden of depression within the U.S. and the treatability of this condition, routine screening when adequate systems are in place to ensure accurate diagnosis and follow-up [10] and monitoring of depression treatment outcomes is recommended [11]. Additionally, both private and public payers require and incentivize depression screening and documentation of depression remission. Thus, it is important for providers and health systems to understand patient-related and systems-level factors associated with depression remission and response rates in real-world treatment settings, as increased understanding of these factors will help to guide the delivery and design of services to help patients achieve remission from depression symptoms.

Previous research has examined factors that influence depression response and remission. Depression remission has been shown to be informed by such factors as patient demographics and health co-morbidities [12]. For instance, Gaynes et al. [12] reported improved depression outcomes for patients who are female, employed, and have higher education and income. On the other hand, behavioral health comorbidities such as anxiety and substance use, medical comorbidities, and lower levels of functioning at baseline were associated with lower rates of depression remission [12].

Primary care patients' depression treatment outcomes may also be impacted by previous traumatic experiences. Notably, Bomyea et al. [13] report that 65-88% of civilians in primary care have been exposed to a traumatic event. Given the high prevalence of trauma exposure reported in civilian primary care populations, and the additional association of trauma symptoms with depression and chronic medical conditions [14], it is important to understand how these symptoms impact depression treatment outcomes. To our knowledge, the impact of trauma symptoms on response to depression treatment has not yet been examined in a systematic way for patients receiving care within an integrated behavioral

health program in primary care. Given the increased implementation of screenings for adverse childhood experiences within primary care settings, it may be expected that more traumatic experiences as well as traumatic stress symptoms will be increasingly identified in primary care patients and that this exposure will need to be taken into account in behavioral health treatment planning [15-16].

Screening and monitoring of treatment often occur through use of the psychometrically-validated, self-report Patient Health Questionnaire-9 (PHQ-9) rating scale, given its high sensitivity and specificity as well as responsiveness to change in symptom severity over time [17-19]. Given the increasing emphasis on quality metrics as they pertain to depression response and remission, this paper examines factors associated with treatment response (defined as PHQ-9 < 10) and remission (defined as PHQ-9 < 5) at 6-months of treatment within a behavioral health and primary care integrated care program, UCLA Behavioral Health Associates (BHA). We anticipate that improved treatment outcomes will be associated with fewer baseline behavioral health co-morbid symptoms of anxiety, substance use, and post-traumatic stress. We also hypothesize that lack of endorsement of suicidal ideation will be associated with improved treatment outcomes. Enhanced understanding of these factors, as present within real-world clinical settings, will inform the design of treatment services to optimally improve depression outcomes.

Methods

Study design

The BHA program was developed by adapting features of the AIMS Center Collaborative Care model to support delivery of behavioral health services to primary care patients within a large, urban medical center. The program includes team-based care with psychiatrists and master's-level therapists in clinics co-located within primary care settings, provision of short-term evidence-based therapies, care coordination, and measurement-based care protocols [20]. E-consultation, with the option for telephone consultation, is provided to primary care providers by psychiatrists. BHA has been in operation since November 2012 and has since expanded to thirteen urban primary care locations within the Los Angeles area.

Data sources

Behavioral health assessment and tracking of results is a core component of collaborative care which enables providers to assess treatment progress and effectively guide care. To accomplish this goal, BHA leadership implemented the UCLA Behavioral Health Checkup (BHC) assessment tool beginning in February 2014 [21]. The BHC is a cloud-based behavioral health assessment and clinician decision-making tool that provides real-time results along with clinical interpretation to inform delivery of care. The BHC consists of psychometrically-validated, patient self-report measures available in the public domain. BHC assessments are completed on a tablet in the clinic waiting room prior to a behavioral health intake appointment and again at 3-month increments and provide an integrated registry within the electronic health record (EHR). To augment BHC data, patient characteristics and visit data were obtained from UCLA's EHR. All data pertained to patients seen at a BHA clinic for treatment of behavioral health symptoms.

Study population

The study sample comprised patients age 18 and older who were screened for depression symptoms on their baseline (first) visit at a BHA clinic between June 2013 and April 2019 and at least once more within six months of their baseline visit. Patients were included in the analytical sample if they reported elevated depression symptoms (PHQ-9 ≥ 10) at their baseline visit. After restricting to adult (18 or older) who initiated treatment on or before April 27, 2019, there were N=6,413 baseline observations. Among those N=6,413, there were N=903 observations missing a PHQ-9 baseline score. After the removal of same-day duplicates, there were N=2,549 unique patients who had a non-missing PHQ-9 score ≥ 10 at their baseline visit. Among those N=2,549, there were N=1,934 who had only one recorded PHQ-9 score in the first six months

of treatment (at baseline). Our final analytical sample consists of N=615 patients with baseline PHQ-9 score ≥ 10 and at least one follow-up PHQ-9 score in the first six months.

Measures

Mental health and substance use. Self-reported mental health and substance use measures were collected from patients during clinic visits through the BHC. Table 1 presents the full list of measures.

Patient characteristics. Self-reported gender, ethnicity, race, and marital status were collected from patients during a clinical visit and recorded in the EHR. Patients had the option to update these characteristics during subsequent visits. Date of birth was also collected and used along with the date of the patient's baseline visit at a BHA clinic to calculate age at baseline. We followed guidelines established by the United States Census Bureau to categorize race responses [31].

Service utilization. Visit information, including visit date and provider type, was recorded in the EHR by BHA staff. Only visits marked as "Completed" were analyzed. Provider type values were re-categorized by mapping Therapist, Social Worker, and Care Coordinator to "Therapist." Total number of sessions was calculated by counting the number of visits in the first six months of treatment.

Statistical analyses

We first assessed 6-month treatment outcome by identifying whether patients had recorded a PHQ-9 score < 10 ("response") or a PHQ-9 score < 5 ("remission") at least once any time in the first six months since their baseline visit. We then used chi-square tests for independence for categorical variables, and two-sample t-tests for continuous variables, to determine any significant differences in demographic and clinical characteristics, and baseline behavioral health conditions, between patients who did and did not demonstrate each treatment outcome. Significant associations were used to identify potential confounding factors controlled for in subsequent analyses.

To test the hypothesis that the presence of comorbid baseline behavioral health symptoms affects the odds of demonstrating response or remission from depression, we fit multinomial logistic regression models (Figure 1) with three outcome categories indicating the level of patients' lowest-recorded PHQ-9 score in the six-months since baseline: a PHQ-9 score < 5 (remission), a PHQ-9 score ≥ 5 and < 10 (response but not remission), or a PHQ-9 score ≥ 10 (maintaining elevated depression symptoms).

We fit three separate multinomial models to evaluate the differential impact of baseline suicidal ideation, baseline anxiety, and baseline traumatic stress individually on treatment outcome, while controlling for the severity of baseline depression symptoms. For this and following analyses, we separated item-9 from the PHQ-9 to obtain baseline suicidal ideation and used baseline PHQ-8 scores to measure baseline depression symptoms.

To evaluate the specific impact of each behavioral health symptom on treatment response and remission while controlling for other baseline behavioral health symptoms, we fit a multinomial logistic regression model with the same three outcome categories (remission, response but not remission, and maintaining elevated depression symptoms) with baseline PHQ-8 score, suicidal ideation, baseline anxiety, and baseline traumatic stress as covariates in the same model. The outcome category corresponding to maintaining elevated depression symptoms was used as the reference. Analyses were conducted using SAS, Version 9.4 and R, Version 3.6.

Results

Demographic and behavioral health characteristics for the 615 patients in the analytical sample are displayed in Table 2. Patients were majority female (66%), single (57%), White/Caucasian (58%), and Not Hispanic/Latino (74%). At baseline,

behavioral health co-morbidities were substantial with 71% reporting clinical symptoms of anxiety, 40% indicating suicidal ideation, and 28% reporting clinical symptoms of traumatic stress. During the 6 months following each patient's baseline visit, patients attended a mean of 7.29 (standard deviation = 4.04) treatment sessions. By 6 months, 47% of patients demonstrated response to treatment and 16% demonstrated remission.

Using two-group comparisons, we found significant associations between response and remission, and numerous baseline behavioral health symptoms (Table 3). Patients who demonstrated response in the first six months had significantly lower depression symptoms at baseline compared to patients who did not demonstrate response (mean diff. = 2.70; $p < 0.01$). The same was true for remission (mean diff. = 2.31; $p < 0.01$). Baseline anxiety was also significantly associated with response and remission, with 63% of patients reporting elevated anxiety symptoms at baseline among those who exhibited response, compared to 78% of patients without response. The prevalence of baseline anxiety was 61% among patients demonstrating remission, compared to 73% among patients who did not demonstrate remission.

Baseline suicidal ideation and traumatic stress were significantly lower among patients who demonstrated response, and among those demonstrating remission, compared to patients who did not demonstrate such improvements. Notably, 25% of patients demonstrating remission reported suicidal ideation at their baseline visit, compared to 43% of patients who did not, while 31% of patients demonstrating response reported any suicidal ideation at baseline compared to almost one-half (48%) of patients who did not demonstrate response. Traumatic stress was also less prevalent among patients who reached remission (13%) compared to patients who did not (32%), and among patients who demonstrated response (21%) compared to patients who maintained elevated depression symptoms (36%).

Results from multinomial regression models (Table 4) indicate significant associations between baseline suicidal ideation and traumatic stress, and remission, even when controlling for baseline depression symptom severity. Specifically, the odds of reaching remission were significantly lower among patients with suicidal ideation and patients with elevated traumatic stress. The odds of remission among patients who reported suicidal ideation at baseline was 0.49 times the odds of patients who did not report suicidal ideation at baseline. The odds of remission among patients with a baseline PCL score > 50 was 0.45 times the odds of remission among patients with a baseline PCL score ≤ 50 . There is no significant association between suicidal ideation or elevated traumatic stress and the probability of attaining *response but not remission* (PHQ-9 score ≥ 5 and < 10). Baseline depression symptoms are strongly associated with the odds of both *response but not remission* and remission in all models.

In a multinomial logistic regression model accounting for all comorbid behavioral health conditions identified as significant in Table 3 (fully adjusted model), we see the persistence of suicidal ideation as significantly associated with remission (Table 5). Similar to results from the individual models, there are no significant associations between *response but not remission* and any baseline behavioral health symptoms in the fully adjusted model. The severity of baseline depression symptoms continues to be significantly associated with both response and remission, even after controlling for baseline suicidal ideation, anxiety, and traumatic stress. A one-unit increase in baseline PHQ-8 score is associated with a 10% decrease in the odds of *response but not remission*, and a 12% decrease in the odds of remission in the first 6 months of treatment. The odds of remission among patients with suicidal ideation is 0.53 times the odds among patients without suicidal ideation, when controlling for baseline PHQ-8 score, traumatic stress, and anxiety. The odds of remission among patients with traumatic stress is 0.52 (95% CL = [0.26, 1.03]) times the odds among patients without traumatic stress, when controlling for baseline PHQ-8 score, suicidal ideation, and anxiety.

Discussion

Depression is a common condition that causes significant mental health morbidity, contributes to poor general health, and is associated with lower quality of life. In fact, depression is the leading cause of disability worldwide [32]. The presence of suicidal ideation and trauma symptoms are important to consider in the treatment of depression, as they are

common in primary care populations [13, 33, 34, 35] and may impact depression treatment outcomes, even after controlling for their associations with baseline depression. Suicidal ideation may occur as a symptom of a depressive episode or it may occur apart from a depressive episode [36]. Suicidal ideation may also be precipitated by trauma [37]. Relatedly, depression itself may be present co-morbid to, or develop as a consequence of, trauma [37].

Within this study, referred primary care patients endorsed significant symptoms of depression, with a mean PHQ-9 score of 15.87, indicative of moderately severe depressive symptoms [18]. Strikingly, on intake 40.33% of patients answered affirmatively on PHQ-9 item 9. The high rate of endorsement on PHQ-9 item 9 among those referred to the program underscores the importance of systematic screening for suicidal ideation and safety planning in the population.

The presence of co-morbid behavioral health symptoms at intake appointment was common among patients referred to the BHA program. Unsurprisingly, anxiety symptoms were highly prevalent (70.57% with GAD-7 Score ≥ 10). Previous research has reported that anxiety symptoms and anxiety disorders are commonly present within primary care settings [38, 39]. The presence of elevated anxiety symptoms on intake was associated with lower likelihood of response or remission from depression within 6-months of treatment. Patients with co-morbid depression and anxiety have a decreased likelihood of remission and increased risk of depression and anxiety severity [40, 41]. Past studies have shown those experiencing co-morbidity also have increased impairment in social and occupational functioning and increased rate of suicide attempts than patients not suffering from comorbidity [40,42,43]. High rates of reported substance use were observed in this population as well, with 37.07% of patients endorsing at-risk alcohol use (AUDIT-C Score ≥ 3 for females and ≥ 4 for males), and 10.41% indicating at-risk drug use (DAST-10 Score ≥ 3). Substances may be used as a coping mechanism by patients with behavioral health symptoms [44, 45].

Depression treatment can be examined in terms of a patient's achievement of response or remission from symptoms and time to treatment outcome. Given the emphasis of the short-term treatment model of the BHA program and increasing emphasis on national quality outcomes monitoring in depression [11], we focused on treatment outcomes for depression at 6-months of treatment.

Similar to previous research, patients who demonstrated response and remission from depression symptoms at 6-months had lower mean depression symptoms on intake. More severe depressive symptoms are associated with poorer functioning and quality of life [46] which are both a sequelae of depression and impact patients' treatment outcomes [12]. Unsurprisingly, the severity of baseline depression symptoms is significantly associated with both response and remission, even after controlling for baseline suicidal ideation, anxiety, and traumatic stress.

Importantly, patients endorsing suicidal ideation on intake were less likely to achieve depression response or remission. Results revealed the odds of remission among patients with suicidal ideation is 0.53 times the odds among patients without suicidal ideation, when controlling for baseline PHQ-8 score, traumatic stress, and anxiety. This is a particularly interesting finding, given presence of suicidal ideation suggests more severe depressive symptoms (higher initial PHQ-9 scores). According to Pompili [36], there is evidence that suicidality itself may impact treatment response to antidepressant medications, independent of overall depression severity. Further, it is noted that "such evidence seems to suggest that depressed, suicidal individual represent a peculiar subgroup of patients that request in-depth clinical observation" [36]. These results suggest clinicians may find utility in examining suicidality as a separate predictive factor in depression treatment. Patients with suicidality may require more aggressive medication management and therapy. Further research is needed in this area.

On intake, 28.29% of patients had a PCL Score > 50 , indicating risk for clinically significant trauma symptoms and possible diagnosis of post-traumatic stress disorder. It has been reported that 2-39% of primary care patients may have a diagnosis of post-traumatic stress disorder (PTSD) [33, 35, 47], with a recent United Kingdom study providing a prevalence estimate of 15.5% [48]. The rate of trauma symptoms reported in this referred population supports these

estimates. The presence of trauma symptoms on intake was associated with lower likelihood of remission from depression within 6-months of treatment after controlling for depression symptom severity on intake. Specifically, in terms of impact on depression outcomes, the odds of remission among patients with a baseline PCL score > 50 was 0.45 times the odds of remission among patients with a baseline PCL score ≤ 50 . Results were similar in the fully adjusted model (odds ratio = 0.52), although not statistically significant. The lower estimated likelihood of remission from depression in these patients indicates that patients with depression should be screened for trauma symptoms. Psychiatric evaluation of this important symptom domain will further inform depression treatments and these results suggest the need for potentially greater service intensity (number of treatment sessions, frequency of sessions) and/or more targeted therapies and medication management to address co-morbid trauma symptoms and possible PTSD diagnosis. Treatment programs may explore the addition of trauma-focused treatments such as cognitive processing therapy, prolonged exposure, or eye movement desensitization and reprocessing therapies [49, 50].

Additionally, patients with challenges in emotional regulation and those exhibiting self-harm behaviors may also benefit from dialectical behavioral therapy [51, 52]. It is important for providers and health systems to understand patient-related and systems-level factors associated with depression remission and response rates in real-world treatment settings. These factors may be employed to increase specificity of treatment services to help patients achieve remission from depression symptoms.

Highlighting difficulties inherent in using EHR data, we relied on system labels to define baseline and follow-up visits. This includes identifying baseline visits as an appointment status labeled as *New*, with subsequent visits assumed to be corresponding follow-ups. A patient's true first visit to BHA could have been earlier than defined. We acknowledge the challenges with generalizability of our results due to the racial/ethnic and economic (e.g. insurance status) composition of our patient population. While our methodological approach satisfies an evaluation of short-term depression outcomes based on often-used clinical cutoffs, we know that many patients continue in BHA after the six-month mark and that evaluation of their longer-term symptom trajectories could offer valuable insight to patterns of symptoms over time. Future work will explore this topic.

Conclusion

Increased understanding of patient- and system-level factors associated with depression treatment outcomes may be employed to help guide the delivery and design of clinical services. Alongside routine screening for co-morbid anxiety, suicidal ideation and traumatic stress should be assessed and considered when designing depression treatment services in real-world settings.

Declarations

- **Ethics approval and consent to participate**

All methods were carried out in accordance with relevant guidelines and regulations. This research protocol was submitted to the Institutional Review Board of a large public university in California, and their determination was that this work did not involve human subjects research, informed consent of participants was not required, and therefore did not require full review.

- **Consent for publication**

Not applicable

- **Availability of data and materials**

The datasets generated and/or analysed during the current study are not publicly available due to privacy restrictions but are available from the corresponding author on reasonable request.

- **Competing interests**

All of the authors declare that they have no conflicts of interest

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- **Authors' contributions**

All authors (JJ, AK, HA, WB, SR, MG, PL) designed the study. JJ conducted the analysis in collaboration with AK, and HA and WB. JJ, AK, HA, WB, SR regularly contributed in analysis discussions. JJ, AK, HA, WB wrote the draft, and all authors (JJ, AK, HA, WB, SR, MG, TL) contributed in manuscript revisions. All authors (JJ, AK, HA, WB, SR, MG, PL) read and approved the final manuscript.

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- **Authors' information (optional)**

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Tables

Table 1 Self-reported measures assessing mental health and substance use

Measure	Domain	Number of Items	Period Assessed	Response Scale	Scoring Algorithm	Cutoff Score	Internal Consistency
Mental Health							
Patient Health Questionnaire-9 (PHQ-9) (Kroenke, Spitzer, & Williams, 2001)	Depression	9	Past two weeks	Likert, 0 ("Not at all") to 3 ("Nearly every day")	PHQ-9 Total Score = sum of all nine items (score range, 0 to 27) PHQ-8 Total Score = sum of items 1 to 8 (score range, 0 to 24) ¹	PHQ-9 Total Score ≥ 10 , moderate-to-severe depression symptoms (Kroenke & Spitzer, 2002)	$\alpha = 0.68$ ($\alpha = 0.86$ prior to excluding patients with PHQ-9 Total Score < 10)
Generalized Anxiety Disorder-7 (GAD-7) (Spitzer, Kroenke, Williams, & Lowe, 2006)	Anxiety	7	Past two weeks	Likert, 0 ("Not at all") to 3 ("Nearly every day")	Total Score = sum of all seven items (score range, 0 to 21)	≥ 10 , moderate-to-severe anxiety symptoms (Spitzer et al., 2006)	$\alpha = 0.84$
Posttraumatic Stress Disorder Checklist (PCL) (Walker et al., 2002) ²	Posttraumatic Stress Disorder (PTSD)	17	Past month	Likert, 1 ("Not at All") to 5 ("Extremely")	Total Score = sum of all 17 items (score range, 0 to 85)	> 50 , clinically significant traumatic stress (Ruggiero, Ben, Scotti, & Rabalais, 2003)	$\alpha = 0.87$
Substance Use							
Drug Abuse Screening Test-10 (DAST-10) (Yudko, Lozhkina, & Fouts, 2007) ³	Drug Use	10	Past 12 months	Dichotomous, 1 ("Yes") or 0 ("No")	Total Score = sum of all 10 items (score range, 0 to 10)	≥ 3 , risk for drug abuse or dependence (Yudko et al., 2007)	$\alpha = 0.58$
Alcohol Use Disorders Identification Test-Consumption (AUDIT-C)	Alcohol Consumption	3	None indicated	Likert, 0 (reflects little or no alcohol use) to 4 (reflects high alcohol use)	Total Score = sum of all three items (score	≥ 3 for females and ≥ 4 for males, risk for alcohol abuse or	$\alpha = 0.64$

(Bush et al., 1998) ⁴	range, 1 to 12)	dependence (Bradley et al., 2007)
<p>¹In part of the study analyses, PHQ-8 scores were used to indicate baseline depression severity and patients who provided any response other than “Not at all” on item 9, which asks about being bothered by “Thoughts that you would be better off dead, or of hurting yourself in some way,” were considered to have suicidal ideation.</p> <p>²Patients who screened positive on the 4-item Primary Care PTSD screening tool (PC-PTSD; Prins et al., 2003), indicated by endorsement of two or more symptoms, were determined to be at risk for PTSD and administered the PCL.</p> <p>³Patients who screened positive on the 1-item substance use screener (Smith & Schmidt., 2010) were administered the DAST-10.</p> <p>⁴Patients who provided any response other than “Never” on item 1 of the AUDIT-C (“How often do you have a drink containing alcohol?”) were administered the remaining two items.</p>		

Table 2 Demographics among patients with elevated depression symptoms at baseline (and at least 2 PHQ-9 scores in the first 6 months)

Demographics (N = 615)	N (%)
Gender	
Male	211 (34.31)
Female	404 (65.69)
Ethnicity	
Hispanic/Latino	99 (16.10)
Not Hispanic/Latino	458 (74.47)
Missing	58 (9.43)
Race	
White/Caucasian	354 (57.56)
Asian	54 (8.78)
Black/African American	35 (5.69)
Two or More Races	19 (3.09)
Other/Unknown ¹	153 (24.88)
Marital Status	
Married/Domestic Partner	209 (33.98)
Previously Married/Domestic Partner	40 (6.50)
Single	348 (56.59)
Other ²	18 (2.93)
Age	
Age at Baseline, Mean (SD)	40.51 (14.82)
Baseline Depression Symptoms	
PHQ-9 Score, Mean (SD)	15.87 (4.56)
Suicidal Ideation at Baseline	
Yes ³	248 (40.33)
Treatment Response by 6-month Follow-up	
PHQ-9 Score < 5	100 (16.26)
PHQ-9 Score < 10	289 (46.99)
≥ 50% Reduction in PHQ-9 Score	215 (34.96)
Other Clinical Symptoms at Baseline^{4,5}	
GAD-7 Score ≥ 10	434 (70.57)
AUDIT-C Score ≥ 3 ⁶	228 (37.07)
DAST-10 Score ≥ 3 ⁷	64 (10.41)

PCL Score > 50	174 (28.29)
Number of Treatment Sessions	
Total, Mean (SD) ⁸	7.29 (4.04)
With a Physician, Mean (SD)	2.81 (2.02)
With a Therapist, Mean (SD)	3.91 (4.33)
¹ "Other/Unknown" includes: "American Indian or Alaska Native", "Native Hawaiian or Other Pacific Islander", "Other", "Unknown" ² "Other" includes: Life Partner, Significant Other, Unknown, Other, Missing ³ Includes any endorsement on PHQ-9 item 9 except "Not at all" ⁴ Percentage is out of the total N =615, though some patients had a missing value on the AUDIT-C, DAST-10, and/or PCL ⁵ For the purposes of the analyses, patients who did not meet screening criteria for a given measure were given a "No" on meeting a clinical threshold (rather than given a missing status) ⁶ Clinical cutoff is ≥ 3 for females, ≥ 4 for males ⁷ Cutoff ≥ 3 indicates at least "moderate" symptoms; patients were only administered the DAST-10 if they screened positive on the 1-item screener ⁸ Includes visits that did not indicate a provider type	

Table 3 Demographic and clinical factors for patients by PHQ-9 score at 6-months¹

	PHQ-9 < 5	PHQ-9 ≥ 5		PHQ-9 < 10	PHQ-9 ≥ 10		Δ PHQ-9 ≥ 50%	Δ PHQ-9 < 50%	
	N ² (% ³)								
Baseline PHQ-9									
Total Score, Mean (SD)	13.94 (3.95)	16.25 (4.58)	**4	14.44 (4.08)	17.14 (4.60)	**	15.40 (4.48)	16.13 (4.59)	
Item 9 ⁵	25 (25.00)	223 (43.30)	**	91 (31.49)	157 (48.16)	**	75 (34.88)	173 (43.25)	*
Gender									
Male	32 (32.00)	179 (34.76)		103 (35.64)	108 (33.13)		78 (36.28)	133 (33.25)	
Female	68 (68.00)	336 (65.24)		186 (64.36)	218 (66.87)		137 (63.72)	267 (66.75)	
Ethnicity									
Hispanic/Latino	15 (15.00)	84 (16.31)		50 (17.30)	49 (15.03)		38 (17.67)	61 (15.25)	
Not Hispanic/Latino	77 (77.00)	381 (73.98)		215 (74.39)	243 (74.54)		158 (73.49)	300 (75.00)	
Missing	8 (8.00)	50 (9.71)		24 (8.30)	34 (10.43)		19 (8.84)	39 (9.75)	
Race									
White/Caucasian	53 (53.00)	301 (58.45)		169 (58.48)	185 (56.75)		125 (58.14)	229 (57.25)	
Asian	9 (9.00)	45 (8.74)		24 (8.30)	30 (9.20)		19 (8.84)	35 (8.75)	
Black/African American	4 (4.00)	31 (6.02)		13 (4.50)	22 (6.75)		7 (3.26)	28 (7.00)	
Two or More Races	5 (5.00)	14 (2.72)		10 (3.46)	9 (2.76)		6 (2.79)	13 (3.25)	
Other/Unknown ⁶	29 (29.00)	124 (24.08)		73 (25.26)	80 (24.54)		58 (26.98)	95 (23.75)	
Marital Status ⁷									
Married/Domestic Partner	41 (41.00)	168 (32.62)		106 (36.68)	103 (31.60)		82 (38.14)	127 (31.75)	
Previously Married/Previous Domestic Partner	6 (6.00)	34 (6.60)		15 (5.19)	25 (7.67)		14 (6.51)	26 (6.50)	
Single	49 (49.00)	299 (58.06)		160 (55.36)	188 (57.67)		111 (51.63)	237 (59.25)	
Other ⁸	4 (4.00)	14 (2.72)		8 (2.77)	10 (3.07)		8 (3.72)	10 (2.50)	
Age									

Age at Baseline, Mean (SD)	39.64 (14.39)	40.67 (14.91)		40.00 (14.43)	40.95 (15.17)		39.87 (14.15)	40.85 (15.18)
Number of Treatment Sessions⁹								
Total ¹⁰ , Mean (SD)	6.96 (4.02)	7.36 (4.05)		7.16 (4.04)	7.41 (4.04)		7.01 (4.03)	7.44 (4.05)
With a Physician ¹¹ , Mean (SD)	2.48 (2.20)	2.88 (1.98)		2.65 (2.05)	2.95 (2.00)		2.67 (2.12)	2.89 (1.97)
With a Therapist ¹² , Mean (SD)	3.86 (4.38)	3.92 (4.33)		3.96 (4.43)	3.87 (4.26)		3.75 (4.43)	3.99 (4.29)
At Risk for Other Behavioral Health Conditions								
Baseline GAD-7 Score ≥ 10	61 (61.00)	373 (72.71)	*	181 (62.63)	253 (78.09)	**	143 (66.51)	291 (73.12)
Baseline AUDIT-C Score ≥ 3 ¹³	31 (31.00)	197 (38.48)		106 (36.81)	122 (37.65)		72 (33.64)	156 (39.20)
Baseline DAST-10 Score ≥ 3 ¹⁴	11 (11.00)	53 (10.29)		25 (8.65)	39 (11.96)		22 (10.23)	42 (10.50)
Baseline PCL Score > 50 ¹⁵	13 (13.00)	161 (31.57)	**	59 (20.56)	115 (35.60)	**	49 (22.90)	125 (31.57) *

¹ Using 180 days (since baseline BHC) as 6-month indicator

² Sample size including only patients who have at least 2 PHQ-9 scores: N=615; PHQ-9 < 5: n=100; PHQ-9 ≥ 5 : n=515; PHQ-9 < 10: n=289; PHQ-9 ≥ 10 : n=326; PHQ-9 $\geq 50\%$ reduction: n=215; PHQ-9 < 50% reduction: n=400

³ Percentages displayed represent “column” percentages

⁴ *p-value < 0.05, **p-value < 0.01; for continuous items, p-values represent two-sample t-test comparing mean scores between patients who have and have not reached “remission”; for categorical items, p-values represent chi-square tests under the null hypothesis of independence between “remission” status and the categorical variable

⁵ Includes any endorsement except “Not at all”

⁶ “Other/Unknown” includes: “American Indian or Alaska Native”, “Native Hawaiian or Other Pacific Islander”, “Other”, “Unknown”

⁷ Significance test

⁸ “Other” includes: Life Partner, Significant Other, Unknown, Other, Missing

⁹ Visits to BHA in the first 6 months

¹⁰ Includes visits that did not indicate a provider type

¹¹ Includes: Physician, Fellow

¹² Includes: Therapist, Social Worker, Care Coordinator

¹³ Clinical cutoff is ≥ 3 for females, ≥ 4 for males; patients were only administered the full AUDIT-C if they did not select “never” on the first item of the AUDIT-C

¹⁴ Cutoff ≥ 3 indicates at least “moderate” symptoms; patients were only administered the DAST-10 if they screened positive on the 1-item screener

Table 4 Multinomial logistic regression models for continued elevated (PHQ-9 ≥ 10), response ($5 \leq \text{PHQ-9} \leq 9$) and remission (PHQ-9 < 5) in the first 6 months, controlling for baseline PHQ-8 score

Effect	PHQ-9 Outcome ¹	Estimate (SE)	OR	95% CL
Baseline Item 9 (Yes vs. No)	PHQ-9 < 5	-0.72 (0.27)	0.49**	(0.29, 0.82)
	$5 \leq \text{PHQ-9} < 10$	-0.29 (0.20)	0.75	(0.51, 1.10)
Baseline PHQ-8 Score	PHQ-9 < 5	-0.16 (0.03)	0.86**	(0.80, 0.91)
	$5 \leq \text{PHQ-9} < 10$	-0.12 (0.02)	0.89**	(0.84, 0.93)
Baseline GAD-7 Score ≥ 10	PHQ-9 < 5	-0.32 (0.26)	0.72	(0.43, 1.22)
	$5 \leq \text{PHQ-9} < 10$	-0.33 (0.22)	0.72	(0.47, 1.10)
Baseline PHQ-8 Score	PHQ-9 < 5	-0.16 (0.03)	0.85**	(0.80, 0.91)
	$5 \leq \text{PHQ-9} < 10$	-0.12 (0.03)	0.89**	(0.85, 0.94)
Baseline PCL Score > 50	PHQ-9 < 5	-0.79 (0.34)	0.45*	(0.23, 0.88)
	$5 \leq \text{PHQ-9} < 10$	-0.07 (0.23)	0.94	(0.60, 1.47)
Baseline PHQ-8 Score	PHQ-9 < 5	-0.14 (0.03)	0.87**	(0.81, 0.93)
	$5 \leq \text{PHQ-9} < 10$	-0.13 (0.03)	0.88**	(0.84, 0.93)
*p-value < 0.05 , **p-value < 0.01				
¹ Relative to PHQ-9 ≥ 10				

Table 5 Multinomial logistic regression model for continued elevated (PHQ-9 ≥ 10), response ($5 \leq$ PHQ-9 ≤ 9) and remission (PHQ-9 < 5) in the first 6 months, including all baseline behavioral health conditions

Effect	PHQ-9 Outcome ¹	Estimate (SE)	OR	95% CL
Baseline PHQ-8 Score	PHQ-9 < 5	-0.13 (0.04)	0.88**	(0.82, 0.95)
	$5 \leq$ PHQ-9 < 10	-0.11 (0.03)	0.90**	(0.85, 0.95)
Baseline Item 9 (Yes vs. No)	PHQ-9 < 5	-0.64 (0.27)	0.53*	(0.31, 0.89)
	$5 \leq$ PHQ-9 < 10	-0.28 (0.20)	0.76	(0.51, 1.13)
Baseline GAD-7 Score ≥ 10	PHQ-9 < 5	-0.16 (0.27)	0.85	(0.50, 1.45)
	$5 \leq$ PHQ-9 < 10	-0.33 (0.23)	0.72	(0.46, 1.13)
Baseline PCL Score > 50	PHQ-9 < 5	-0.66 (0.35)	0.52	(0.26, 1.03)
	$5 \leq$ PHQ-9 < 10	0.06 (0.24)	1.06	(0.66, 1.69)
*p-value < 0.05 , **p-value < 0.01				
¹ Relative to PHQ-9 ≥ 10				

Figures

Figure 1

Multinomial logistic regression odds ratios for continued elevated ($\text{PHQ-9} \geq 10$), response ($5 \leq \text{PHQ-9} \leq 9$) and remission ($\text{PHQ-9} < 5$) in the first 6 months, including all baseline behavioral health conditions