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Depression Remission, Receipt of Problem-Solving Therapy, and Self-Care Behavior Frequency among Low-Income, Predominantly Hispanic Diabetes Patients

Hyunsung Oh, PhD^a and Kathleen Ell, DSW^b

^aSchool of Social Work, Arizona State University

^bSchool of Social Work, University of Southern California

Abstract

Objective—This study explored whether depression remission and problem-solving therapy (PST) receipt are associated with more frequent self-care behaviors via cross-sectional and prospective analyses.

Method—We analyzed data from a randomized clinical trial ($N = 387$) that tested collaborative depression care among predominantly Hispanic patients with diabetes in safety-net clinics. Data at 12-month follow-up, measured with the Patient Health Questionnaire-9 and Hopkins Symptom Checklist-20, were used to define depression remission. PST was provided by a bilingual social worker. Multivariate regression analysis was used to examine associations between predictors and frequency change of each self-care behavior (healthy diet, exercise, self-blood glucose monitoring, and foot care between baseline and 12-month ($N = 281$), 18-month ($N = 249$), and 24-month ($N = 235$) follow-up surveys.

Results—Inconsistent relationships were observed depending on the instrument to identify depression remission, type of self-care behaviors, and time when self-care behavior was measured. Significant associations were more likely to be observed in cross-sectional analyses. PST receipt was not associated with self-care behaviors.

Conclusions—Depression remission or the receipt of PST may not be a reliable antecedent for more frequent self-care behaviors among this group. A few recommendations for studies were offered to enhance existing depression care for diabetes patients.

Keywords

Diabetes; Depression; Problem-Solving Therapy; Self-care Behaviors

Correspondence concerning this article should be addressed to Hyunsung Oh, PhD (hyunsung@asu.edu; 1-602-496-0518), 411 N. Central Ave. Suite 800, Phoenix, AZ 85004.

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1. Introduction

Benefits of Self-care behaviors related to diabetes include not only keeping blood glucose level in the recommended range (e.g., regular exercise, self-blood glucose monitoring [SBGM], medication adherence), but also preventing possible complications (e.g., foot care) [1–3]. Activated self-care behaviors are associated with better diabetes outcomes [3,4]. For instance, individuals who learned structured SBGM demonstrated a 1.2% decrease in A1C levels when compared to the baseline among noninsulin-treated patients [3]. Six-month muscle resistance training also resulted in a 1.2% decline in A1C levels at the 6-month assessment [2]. A prospective study that followed patients with diabetes for 10 years demonstrated that intensive self-care behaviors intervention had significant effects on weight, waist circumference, physical fitness, and A1C level [5].

Depression is significantly associated with negative self-care behavior outcomes [6–9]. A meta-analysis demonstrated that patients with diabetes and depression were less likely to adhere to self-care behaviors [10]. Similar findings were also observed in studies with nondiabetic population; for example, a 15% higher prevalence of sedentary lifestyle was found when depression was diagnosed [11]. Decline in motivation to follow prescribed self-care behaviors is believed to be attributable to symptoms of depression, such as loss of interest in or decreased pleasure with daily routines, helplessness, or pessimism in the future [10,12]. Depression is also associated with lower self-efficacy to implement self-care behaviors that are usually prescribed by primary care physicians and dieticians [13,14]. These findings in observational studies indicate that decline in depressive symptoms may improve self-care behaviors, and a few studies investigating the effectiveness of depression treatment for patients with diabetes also measured self-care behavior frequencies as a secondary outcome to examine whether depression treatment also encouraged more frequent self-care behaviors [15–18].

Theory and previous studies have suggested that self-care behaviors are influenced by depression care [10, 12–15]. For some patients, depression care may motivate daily self-care via enriching psychological resources, such as improved self-efficacy or optimism [9]. Depressive symptoms are negatively associated with these psychological resources, which are significant for maintaining a daily self-care behavior schedule that needs to be followed every day [10]. Based on previous findings, it is plausible that more frequent self-care behaviors would be observed among individuals demonstrating significant improvement in depressive symptoms. However, there is little empirical evidence supporting the assumption of a positive correlation between depression remission and more frequent self-care behaviors. Contrary to ample evidence from observational studies demonstrating significant associations between increased depressive symptoms and less frequent self-care behaviors [6,10,19–23], limited evidence is available to determine whether depression remission precedes more frequent self-care behaviors. There is inconsistency between findings from clinical trials, such as statistically non-significant mean differences in frequency of each self-care behaviors between intervention and comparison groups [16–18, 24]. One clinical trial in primary care clinics demonstrated a lack of correlation between improved depressive symptoms and frequency of diet and exercise [24]. Clinical studies often assess depression

remission as an indicator if clinically meaningful improvement induced by depression care [25–27].

We are also interested in assessing efficacy of Problem-Solving Therapy (PST) in collaborative depression care intervention on diabetes management. The collaborative depression care provided in a primary care clinics offered PST as an alternative for antidepressants and this modified version of PST attends to successful diabetes self-care management as opposed to a traditional PST model [18, 28, 29]. PST was originally developed to assist healthy patients with clinical depression to build up problem solving skills to treat depressive symptoms by helping understanding social stressors, generating alternatives, assessing positive and negative consequences, and carrying out a solution effectively [21–23]. The modified PST for patients with diabetes is much shorter than the precursor and emphasizes integrating depression into diabetes management [18, 30] since empirical evidence suggests a bi-directional relationship between comorbid depression and diabetes-related stressors [31, 32]. During therapy sessions, patients are helped to navigate barriers for successful diabetes management since distress related to failed or burdensome self-management of diabetes is a powerful contributor to depression [18, 29]. Also problem solving is a core self-management skills in many self-management trainings because enhancing self-efficacy is regarded as a main mechanism by which patients with chronic illness can improve managing their chronic illnesses and fostering problem solving skill is regarded necessary for better self-efficacy [33]. A systematic review concluded that diabetes patients with better problem-solving skills had lower A1C level and better adherence to self-care behaviors [34]. However, it is not clear whether the modified PST within the collaborative depression care can induce more frequent self-care behaviors since improving self-care was not explicitly targeted in the model. Compared to existing diabetes self-management interventions [33, 35–37], the extent to which the therapist provides tips and knowledge helping to improve self-efficacy related to self-care behaviors were limited. For instance, the Stanford diabetes management model for Spanish speakers offer 2.5 hours training per week for six weeks for self-management [37] whereas the Multifaceted Diabetes and Depression Program (MDDP) study offered 8–12 one-hour sessions in which depression plus self-care curriculum was provided by a social worker [28].

To fill the gap, we conducted secondary analysis using data from the MDDP, which tested the effectiveness of collaborative depression care among predominately Hispanic patients [16]. Because the Patient Health Questionnaire-9 (PHQ-9) and Hopkins Symptom Checklist-20 (SCL-20) effectively estimate the diagnosis and remission of clinical depression in clinical trials testing depression treatments [16–18, 27, 35, 38], we used the two measures to examine whether depression remission is predictive of more frequent implementation of patient self-care behaviors. In addition, we examined whether PST is independently associated with changes in self-care behavior frequency when depression remission is included in the same statistical model. To capitalize on the richness of multiple follow-ups in this randomized controlled trial, both cross-sectional and prospective associations were examined. Last, to replicate previous efforts [16–18], the Summary of Diabetes Self-Care Activities (SDSCA) was used to measure self-care behavior adherence in terms of weekly implementation of healthy diet, exercise, SBGM, and foot care [39, 40].

2. Methods

Patients were randomized to enhanced usual care or a collaborative depression intervention. The intervention group included PST or antidepressant medication or both based on a stepped-care algorithm; first-line patient treatment choice; telephone treatment response, adherence, and relapse prevention follow-up for 12 months; and patient navigator assistance. With respect to PST delivery to the intervention group, each PST enrolled patient was expected to receive 8 to 12 PST sessions and another booster session if necessary [4,5]. Among patients who received PST, the average number of sessions delivered was 9.08 at Time 3, 8.87 at Time 4, and 8.86 at Time 5; the three follow-up surveys had similar standard deviations (5.54, 5.27, and 5.6, respectively). Both groups received standard clinic care, educational pamphlets on depression, and a community resource list. Depression screening results for both groups were sent to their clinic primary care physician. Intervention patients had significantly greater depression improvement [16]; however, a smaller proportion of patients in the enhanced usual care group also demonstrated depression remission at follow-ups [41]. Intervention patients were offered PST sessions, in which they learned how to clearly understand problems in the social and interpersonal domains, generate better alternatives, optimally assess possible consequences, and carry out a solution effectively and systematically [20–23,42]. Although Intervention patients were offered depression treatment, not all patients received treatment [16]. Bilingual master-level social workers assessed patient life stressors and facilitated problem-solving processes based on a PST manual culturally adapted for Hispanic patients with respect to language and socio-cultural factors [16, 23]. This secondary analysis focused on actual receipt of PST.

Depression was measured by the PHQ-9 and SCL-20 [43, 44]. The PHQ-9 was originally developed as a brief self-reported measure for patients in primary care clinics [27]. The PHQ-9 assesses the frequency of selected symptoms during the previous 2 weeks, ranging from 0 (*not at all*) to 3 (*nearly every day*) [43]. Depression severity was calculated by summing the responses to the nine items, ranging from 0 (*minimal depressive symptoms*) to 27 (*highest depressive symptoms*). The PHQ-9 has been used in randomized controlled trials to assess the effectiveness of collaborative psychological and pharmacological treatment aimed at reducing depression and general emotional distress [18, 27, 43]. The SCL-20 assesses also vegetative symptoms [44] and has been found to be a reliable and valid measure of distress in medical populations, and is more sensitive to change over time than the Hamilton Rating Scale for Depression or the Inventory of Depressive Symptoms in studies in primary care settings [26, 45]. Patients with a PHQ-9 score less than 5 or an averaged SCL-20 score less than 0.5 are considered to be depression remission; these cutoffs have been widely used in collaborative care studies [15–18, 26, 27, 38, 46].

The SDSCA assesses patient self-care behaviors in terms of the extent of daily adherence to specific self-care behaviors recommended for patients with diabetes patients [39,40]. Patients provided information on these behaviors relative to the preceding week. The SDSCA measures six types of self-care behaviors: (a) general healthy eating (two items), (b) specific healthy eating (two items), (c) physical activities (two items), (d) regular SBGM (two items), (e) foot care (two items), and (f) smoking (one item). Respondents are asked to rate each item from 0 (*never*) to 7 (*every day during the past week*). Scoring was conducted

according to recommendations by Toobert et al. [39]. Two healthy eating domains were combined to measure the extent of overall healthy diet. Aggregation of scores across subdomains is not recommended due to lower inter-item correlation [39] and varied values of inter-item correlation [46]. Although the SDCSA's internal consistency was .68 for all items, the item-to-total correlation ranged from $-.22$ (high-fat diets) to $.58$ (SBGM) [46]. Of note, a negative correlation was found for an item assessing the consumption of a high-fat diet, which seems consistent with the finding that more active patients with diabetes experience occasions when they are offered foods with high fat and carbohydrate content [46]. The SDCSA has been used in observational studies [6,47,48] and randomized controlled trials [16,18,23] involving patients with diabetes.

Regression analyses were conducted to examine the research questions, i.e., whether depression remission and receiving PST are associated with improved patient self-care. To capitalize on multiple follow-ups in these data, three regression analyses were developed: a cross-sectional analysis and two prospective analyses. In the prospective analyses, self-care behavior frequencies were measured either 6 (T_4) or 12 (T_5) months after the follow-up point when depression remission was observed (T_3). To adhere to the depression remission cutoffs of less than 5 on the PHQ-9 and an average score of 0.5 on the SCL-20 [16,18,24,26,37,45], we conducted two analyses with each variable. For each analysis, four dependent variables were examined: weekly frequency of (a) healthy diet, (b) exercise, (c) SBGM, and (d) foot care. By controlling for baseline self-care behavior frequency, our results revealed the explained variance of change in self-care frequency since baseline by depression remission status at T_3 . We controlled for confounders including age, study arm, education, gender, marital status, dysthymia, language, and insulin treatment at baseline. We conducted two ad hoc sensitivity analyses to confirm the robustness of findings. First, we conducted cross-sectional analyses (see appendix 1 and Appendix 2 in supplemental document) to confirm any different associative patterns. Specifically, three cross-sectional analyses using the same follow-up points of T_3 , T_4 , and T_5 , were conducted using either PHQ-9 or SCL-20 scores to assess depression remission. Second, we conducted analyses with interval-scale depressive symptoms to examine whether type 2 error occurred because we lowered the level of measurement of depression to a nominal scale rather than an interval scale (see Appendix 3 and Appendix 4). An alpha level of .05 was used to indicate statistical significance. SPSS 21.0 was used for all statistical analyses.

3. RESULTS

Recruitment was conducted in two federally qualified health centers in an urban area located in Southern California. The MDDP trained bilingual study recruiters identified patients with diabetes from medical charts. Patients provided verbal consent to complete PHQ-9 depression symptom screening and 387 eligible patients provided written informed trial consent [16]. Initially, 1803 patients were approached and 1729 patients were screened for depression by using the PHQ-9 depression screener. Among them, 523 (30.2%) were eligible for participation meeting major depressive disorder criteria and 387 (78.7% of eligible) enrolled the study. More details can be found in the Consort chart published in a previous article [16]. The MDDP collected data at baseline (T_1) and 6 (T_2), 12 (T_3), 18 (T_4), and 24 (T_5) months postbaseline. The secondary analysis analyzed patients from both

study groups who participated in $T3$ ($n = 281$), $T3$ and $T4$ ($N = 249$), and $T3$ and $T5$ ($N = 235$) follow-up surveys (see Table 1). Table 1 demonstrates patient's demographic and clinical characteristics of included individuals and those who dropped out. Patients with less education were more likely to participate in the 18-month assessment ($p < .05$). Spanish-speaking patients were more inclined to participate in the 12- and 18-month assessments ($p < .05$). Finally, patients who responded to the 24-month follow-up demonstrated significantly higher scores in SBGM at baseline ($p < .05$). No other statistically significant differences were found.

Table 2 demonstrates a cross-tab between receiving PST and depression remission status determined by either the PHQ-9 or SCL-20. We found no significant bivariate association between these two variables ($p > .05$).

Table 3 demonstrates results from multivariate regression analyses that included depression remission status at $T3$ determined by PHQ-9's criterion. Depression remission and receiving PST were largely not associated with change in frequency in self-care behaviors in two prospective models: $T1$ to $T4$ and $T1$ to $T5$, whereas findings from the cross-sectional analyses demonstrated significant associations between depression remission and more frequent healthy diet ($p < .05$) and exercise ($p < .05$). Notably, baseline frequency of self-care behavior was the most reliable predictor of variability in changes in frequency of self-care behaviors across analyses. Last, we found no significant association between PST receipt and the frequency of any self-care behavior in either cross-sectional or prospective analyses ($p < .05$).

Table 4 displays results of analyses that replicated the same analyses shown in Table 3 but assessed depression remission status using the SCL-20, which is widely used in many studies examining the effectiveness of collaborative depression care for patients with diabetes. We confirmed the results shown in Table 3, except for a few additional relationships between depression remission and self-care frequencies observed in cross-sectional and prospective analyses. Specifically, depression remission at $T3$ was significantly associated with more frequent SBGM ($p < .01$) and foot care ($p < .001$) in cross-sectional analyses. Also, depression remission significantly predicted more frequent healthy diet at $T4$ ($p < .01$) and more frequent exercise at $T5$ ($p < .05$). Consistent with analyses shown in Table 3, PST receipt was not associated with change in frequency of self-care behaviors in any tested models ($p > .05$). Last, to confirm the robustness of findings shown in Table 3 and Table 4, we performed sensitivity analyses by conducting cross-sectional analyses at each follow-up (appendix 1 and Appendix 2) and the same analyses using interval-level depressive symptom variables (appendix 3 and Appendix 4). These investigations generated similar findings.

4. DISCUSSION

We believe this study is the first attempt to directly examine whether depression remission lead to behavioral change among patients with diabetes and comorbid depression by using a data collected from a clinical trial. Our findings suggest a rejection of the implicit belief that depression remission predicts more frequent self-care behavior [e.g., 14]. Contrary to ample

evidence supporting efficacy of depression care regarding depressive symptoms and diabetes outcomes (e.g., A1C), studies were equivocal with regard to whether depression remission leads to behavioral change related to diabetes management [16–18, 24]. Findings have offered more questions than definitive answers regarding how depression care should be designed and implemented for low-income Hispanic patients with comorbid depression. We hope this secondary research will activate future analyses that replicate our study with data from different clinical trials and closely scrutinize bio-psychosocial mechanisms by which patients with comorbid depression change their behavioral patterns related to diabetes management. Future studies may guide the improvement of whole-person focused health care that new medical models (e.g., Patient-Centered Medical Home) are actively pursuing.

Why did depression remission have limited covariance with changes in self-care behavior frequency, even after controlling for demographic (e.g., gender) and trial-related (e.g., study arm assignment) attributes? The findings offer a conservative position in suggesting a causal relationship between depression remission and change related to self-care behaviors.

Depression is a strong predictor of poor diabetes management. However, we don't know what specific changes in bio-psychosocial attributes of patients occur when their clinical depression is treated. Our findings suggest that researchers might be missing important factors that are necessary to induce behavioral change among patients who experienced clinical depression. Observational studies have found other influential factors, including perception of competence [49], self-efficacy, problem-solving skill [24, 50], or patient activated chronic illness management [51]. It seems depression remission is not a sufficient condition but a necessary condition for behavioral change. Also, contemporary research have largely focused on individual-level attributes, such as genetic vulnerability, depression, and disease severity, to explain variance in self-care behaviors [12]. We learned that socioecologic supports for patients with diabetes have significant associations with more frequent healthy eating and exercise [51, 52]. The importance of social-level variables is not new; many theories already proposed mechanisms by which social contacts can influence an individual's behaviors [53–55]. It is possible that the null finding is only observed because our sample featured low-income Hispanics whose ability to use English is highly limited. Studies involving social-level variables may explain between-group variance among ethnic groups. For example, in Hispanic communities, women with diabetes are often asked to give up a low-carb diet because family members expect them to continue making traditional meals, which typically have high carb and fat content. Also, methodological advances in system science (e.g., social network analysis) allow to conduct sophisticated research to understand larger contexts' impacts on human behaviors [56]. We believe this is a good time to incorporating social-level variables into our clinical studies to navigate the unexplained variance of diabetes management.

Another null finding was observed in the relationship between receiving PST and self-care behaviors, suggesting that PST may not sufficiently induce more frequent self-care behaviors, measured with the SDCSA. The null finding is not surprising because even diabetes self-management interventions, which offer extensive self-care behavior training, were also unable to demonstrate more frequent self-care behaviors among racial minority participants [57] as well as depression care involving PST [17,18,24]. Successful diabetes self-management support has devoted more resources and time to offer self-management

support to help diabetes patients to gain enhanced self-efficacy and problem solving skills[33, 37], whereas PST in the MDDP didn't weigh in improving self-efficacy for diabetes management [33]. Thus PST may require more tailoring to facilitate observable behavioral change by incorporating activities and contents from other diabetes self-management programs, particular for Hispanics [37]. We believe that clinical trials focused on the efficacy of treating comorbid depression needs to use outcomes related to self-care behaviors as a primary benchmark for an effective intervention because treatment for comorbid depression implicitly aims for better diabetes management. This change seems better aligned with the aims of the Chronic Care Model that emphasize the importance of psychosocial care to enhance a patient's disease management [58]. Strategies used in self-care behavior training are instrumental to refine PST as well [59]. Also, our findings suggest further studies that explore any conflict between activities to treat depressive symptoms and those to manage diabetes because sometimes, psychotherapy for mental illness may conflict with the aims of chronic physical illness care [60]. For example, patients with depression are often encouraged to plan pleasurable activities in cognitive-behavioral therapy to alleviate social avoidance. However, this plan might contribute to increased consumption of unhealthy food because some patients meet their friends and families in locations where a diabetes-specific diet is not available (e.g., a fast-food restaurant) [60].

Study limitations include a significant number of patients dropped out before follow-up surveys. At baseline, education, language, and SBGM were found to be statistically significantly different between the two groups (those who completed follow-ups vs. those who dropped out). Second, we used the SDSCA to measure the level of self-care behaviors; alternative approaches to measure the same construct would offer more accurate data. It is plausible that SDSCA may have introduced relatively larger error. Previous study argued that SDSCA might introduce errors, such as recall bias, and increase type 2 errors related to statistical inference [61–62]. Replicating studies that use other tools to measure self-care behaviors via other self-reported instruments (e.g., total minutes per week of aerobic exercise) [50], A1C level, or electronic monitoring through meters or sensor-attached gadgets are necessary to build more credible evidence about the associations between depression remission, PST, and self-care behaviors.

Our findings are consistent with aims of the chronic care model [60], which emphasizes a multifaceted approach to activate a patient's chronic illness management in which depression remission may not be a sufficient condition for behavioral change. Therefore, it is worthwhile to consider a comprehensive approach that includes evidence-based self-management training for patients with diabetes [63], which has been proposed in review papers focusing on both diabetes management and comorbid mental health conditions [18, 58, 64,65]. Also, further studies are also needed to test the effect of PST if it includes an evidence-based approach to self-management for patients with diabetes that demonstrates significant improved self-care behaviors [37].

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Comparison of demographic and clinical characteristics at baseline survey between patients who analyzed and who dropped out.

	12 months			18 months			24 months		
	Analysed (N = 281)	Drop-outs (N = 106)	P	Analysed (N = 249)	Dropouts (N = 138)	P	Analysed (N = 235)	Dropout (N = 152)	P
	N (%)	N (%)	P	N (%)	N (%)	P	N (%)	N (%)	P
<i><u>Demographic Characteristics</u></i>									
Age 50	206 (73.3%)	73 (68.9%)	.39	183 (73.5%)	96 (69.6%)	.41	170 (72.3%)	109 (71.7%)	.89
Intervention group	142 (50.5%)	51 (48.1%)	.67	128 (51.4%)	65 (47.1%)	.42	124 (52.8%)	69 (45.4%)	.16
Female	234 (83.3%)	84 (79.2%)	.36	206 (82.7%)	112 (81.2%)	.70	198 (84.3%)	120 (78.9%)	.18
Only Spanish speaking	244 (86.8%)	83 (78.3%)	.04	217 (87.1%)	110 (79.7%)	.05	204 (86.8%)	123 (80.9%)	.12
Less than high school graduate	236 (84.0%)	81 (76.4%)	.08	211 (84.7%)	106 (76.8%)	.05	194 (82.6%)	123 (80.9%)	.68
Marital status			.62			.52			.49
Married	142 (50.5%)	49 (46.2%)		128 (51.4%)	63 (45.7%)		121 (51.5%)	70 (46.1%)	
Separated	104 (37.0%)	45 (42.5%)		91 (36.5%)	58 (42.0%)		85 (36.2%)	64 (42.1%)	
Never married	35 (12.5%)	12 (11.3%)		30 (12.0%)	17 (12.3%)		29 (12.3%)	18 (11.8%)	
<i><u>Baseline Clinical Characteristics</u></i>									
Dysthymia	158 (56.2%)	56 (52.8%)	.55	141 (56.6%)	73 (52.9%)	.48	132 (56.2%)	82 (53.9%)	.67
On insulin treatment	78 (27.8%)	29 (27.4%)	.94	71 (28.5%)	36 (26.1%)	.61	65 (27.7%)	42 (27.6%)	.99
	Mean (SD)	P		Mean (SD)	P		Mean (SD)	P	
SCL-20	1.54 (0.71)	.71	1.55 (0.72)	1.56 (0.74)	.94	1.54 (0.71)	1.57 (0.76)	.73	
PHQ-9	14.59 (2.88)	.18	14.62 (2.87)	14.89 (3.10)	.39	14.57 (2.85)	14.94 (3.10)	.23	
Diet	4.25 (1.74)	.64	4.22 (1.73)	4.37 (1.89)	.43	4.25 (1.71)	4.30 (1.91)	.80	
Exercise	2.03 (2.37)	.55	2.03 (2.35)	1.90 (2.38)	.58	2.04 (2.33)	1.90 (2.41)	.57	
SBGM	2.77 (2.82)	.19	2.75 (2.79)	2.48 (2.82)	.36	2.88 (2.86)	2.30 (2.69)	.05	
Foot care	4.99 (2.79)	.57	5.05 (2.74)	4.74 (2.92)	.30	4.96 (2.80)	4.92 (2.83)	.87	

Table 2

Depression remission at T3 (12-month post-baseline) and PST receipt

Received PST during 12 months	PHQ-9 <5 (remission)	PHQ-9 5 (No remission)	χ^2 test	SCL-20 0.5 (remission)	SCL-20 0.5 (no remission)	χ^2 test
YES	50 (38.8%)	79 (61.2%)	$\chi^2=2.61$ $p>.05$.	48 (37.2%)	81 (62.8%)	$\chi^2=.003$ $p>.05$.
No	45 (29.6%)	107 (70.4%)		57 (37.5%)	95 (62.5%)	
Total	95 (33.8%)	186 (66.2%)	281 (100%)	105 (37.4%)	176 (62.6%)	281 (100%)

Table 3

Association between remission in PHQ-9 at 12-month follow-up, PST receipt, and self-care behavior frequency changes (T3 – T1, T4 – T1, and T5 – T1)

	Diet		Exercise ^a		SBGM ^a		Foot care ^a	
	<i>B</i> (S.E.)	β	<i>B</i> (S.E.)	β	<i>B</i> (S.E.)	β	<i>B</i> (S.E.)	β
weekly frequency between 12-month follow-up and baseline (T3 – T1) N=281								
Frequency at baseline	.30(.05)***	.33	.17(.05)***	.19	.37(.05)***	.42	.13(.04)***	.21
Depression remission (PHQ-9) at T3	.52(.20)*	.16	.09(.04)*	.14	.02(.04)	.03	.03(.03)	.06
History of PST receipt	-.07(.18)	-.02	-.05(.04)	-.08	.01(.04)	.02	.03(.03)	.06
weekly frequency between 18-month follow-up and baseline (T4 – T1) N=249								
Frequency at baseline	.33(.06)**	.33	.15(.06)*	.15	.36(.06)**	.38	.09(.05)*	.14
Depression remission (PHQ-9) at T3	.46(.24)	.13	.03(.05)	.04	.01(.05)	.02	.02(.03)	.03
History of PST receipt	.19(.22)	.05	-.06(.04)	-.09	.03(.04)	.04	.03(.03)	.06
weekly frequency between 24-month follow-up and baseline (T5 – T1) N=235								
Frequency at baseline	.40(.07)***	.39	.21(.06)**	.22	.30(.06)***	.33	.17(.04)***	.29
Depression remission (PHQ-9) at T3	.31(.25)	.08	.06(.05)	.09	-.02(.05)	-.03	.04(.03)	.09
History of PST receipt	.27(.23)	.08	-.02(.04)	-.04	.01(.05)	-.01	.02(.03)	.04

* $p < .05$;

**

$p < .01$;

$p < .001$.

Note. Each regression model controlled for confounders, including age, study group membership in the MDDP, education, gender, marital status, dysthymia at baseline, Spanish-only use, insulin use at 12 month, and baseline PHQ-9 score, and focal self-care behavior frequency at baseline.

^aVariables were log transformed to satisfy the normality of residual.

Table 4

Association between remission in SCL-20 at 12-month follow-up, PST receipt, and self-care behavior frequency changes (T3 – T1, T4 – T1, and T5 – T1)

	Diet		Exercise ^a		SBGM ^a		Foot care ^a	
	<i>B</i> (S.E.)	β	<i>B</i> (S.E.)	β	<i>B</i> (S.E.)	β	<i>B</i> (S.E.)	β
weekly frequency between 12-month follow-up and baseline (T3 – T1) N=281								
Frequency at baseline	.30(.05)***	.34	.18(.05)**	.20	.36(.05)***	.41	.14(.04)**	.22
Depression remission (SCL-20) at T3	.56(.19)**	.17	.12(.04)**	.19	.15(.04)***	.21	.10(.03)***	.22
History of PST receipt	-.03(.18)	-.01	-.03(.04)	-.05	-.00(.04)	-.00	.02(.03)	.04
weekly frequency between 18-month follow-up and baseline (T4 – T1) N=249								
Frequency at baseline	.34(.06)***	.34	.16(.06)*	.16	.35(.06)***	.37	.10(.05)*	.15
Depression remission (SCL-20) at T3	.64(.23)**	.18	.11(.05)	.15	.04(.05)	.05	.04(.03)	.08
History of PST receipt	.20(.22)	.06	-.08(.04)	-.12	.03(.04)	.04	.02(.03)	.05
weekly frequency between 24-month follow-up and baseline (T5 – T1) N=235								
Frequency at baseline	.39(.06)***	.38	.21(.06)**	.22	.29(.06)***	.32	.16(.04)***	.27
Depression remission (SCL-20) at T3	.26(.24)	.07	.09(.04)*	.14	.02(.05)	.02	.04(.03)	.10
History of PST receipt	.35(.23)	.10	-.01(.04)	-.02	-.01(.05)	-.02	.03(.03)	.08

* $p < .05$;

** $p < .01$;

*** $p < .001$.

Note. Each regression model controlled for confounders, including age, study group membership in the MDDP, education, gender, marital status, dysthymia at baseline, Spanish-only use, insulin use at 12 month, and baseline SCL-20 score, and focal self-care behavior frequency at baseline.

^aVariables were log transformed to satisfy the normality of residual.