

Role of Motivation in the Relationship Between Depression, Self-care, and Glycemic Control in Adults With Type 2 Diabetes

Purpose

The mechanism by which depression influences health outcomes in persons with diabetes is uncertain. The purpose of this study was to test whether depression is related to self-care behavior via social motivation and indirectly related to glycemic control via self-care behavior.

Methods

Patients with diabetes were recruited from an outpatient clinic. Information gathered pertained to demographics, depression, and diabetes knowledge (information); diabetes fatalism (personal motivation); social support (social motivation); and diabetes self-care (behavior). Hemoglobin A1C values were extracted from the patient medical record. Structural equation models tested the predicted pathways.

Results

Higher levels of depressive symptoms were significantly related to having less social support and decreased performance of diabetes self-care behavior. In addition, when depressive symptoms were included in the model, fatalistic attitudes were no longer associated with behavioral performance.

Leonard E. Egede, MD

Chandra Y. Osborn, PhD, MPH

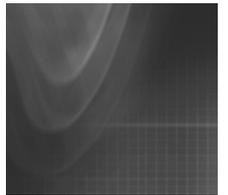
From the Department of Medicine and the Center for Health Disparities Research, Medical University of South Carolina, Charleston (Dr Egede); Center for Disease Prevention and Health Interventions for Diverse Populations, Ralph H. Johnson VA Medical Center, Charleston, South Carolina (Dr Egede); Department of Medicine and Vanderbilt Eskind Diabetes Center, Diabetes Research & Training Center, Vanderbilt University School of Medicine, Nashville, Tennessee (Dr Osborn).

Correspondence to Leonard E. Egede, MD, Medical University of South Carolina, Center for Health Disparities Research, 135 Rutledge Avenue, Room 280H, Charleston, SC 29425; e-mail: egedel@musc.edu.

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Conclusions

Among adults with diabetes, depression impedes the adoption of effective self-management behaviors (including physical activity, appropriate dietary behavior, foot care, and appropriate self-monitoring of blood glucose behavior) through a decrease in social motivation.

Multiple studies have documented significantly higher rates of depression among persons with diabetes relative to the general population.¹⁻⁵ Depression affects approximately 30% of adults with diabetes⁴ and is strongly associated with poor glycemic control,^{6,7} increased risk of complications,⁸ increased disability,^{2,9} lost productivity,^{2,10} increased health care costs,¹¹ and increased mortality.¹²

In diabetes, multiple studies have also documented that depression is associated with poor glycemic control and poor self-care behaviors.¹³⁻¹⁶ However, the mechanism by which depression influences health outcomes in persons with diabetes is uncertain. Depression has been hypothesized to decrease physical health by a combination of biological and psychological mechanisms, including (1) psychological distress and subsequent neurohormonal and immunologic changes that increase susceptibility to disease; (2) persistent somatic symptoms of depression, which are thought to worsen physical health over time; and (3) interference with physical recovery by impeding treatment seeking, adherence, and adoption of healthy lifestyles.¹⁵ The current authors previously proposed a conceptual framework of the relationship between depression and diabetes health outcomes based on the premise that depression exerts its influence on diabetes-related health outcomes through decreased motivation to maintain behaviors that are protective against worsening of metabolic control and development of complications.¹⁵ In that article, it was proposed that depression impedes treatment-seeking behavior, medication adherence, and adoption of effective self-management behaviors (including physical activity, appropriate dietary behavior, and appropriate self-monitoring of blood glucose behavior) via a decrease in motivation.¹⁵

The information-motivation-behavioral skills model of health behavior change¹⁷⁻²⁰ provides a rational theoretical

framework to test this hypothesis and improve understanding of the psychological mechanisms underlying the relationship between depression, self-care behavior, and glycemic control in adults with type 2 diabetes (T2DM). The Information-Motivation-Behavioral skills (IMB) model of health behavior change posits that behavior-specific information, motivation (eg, positive personal beliefs and attitudes toward a behavior or outcome, and social support for the behavior), and requisite skills to execute a behavior as well as the confidence in one's ability to do so across various situations are critical determinants of behavioral performance.¹⁷⁻²⁰ Essentially, one who is well informed and motivated to act is thought to develop and enact the skills necessary to perform the behavior at focus and is likely to ultimately reap greater health benefits.^{18,19} The model's constructs and relationships among them have been well supported across populations and health promotion behaviors^{18,19}; however, very minimal work has been done in diabetes.

The objective of this study was to (1) to determine whether the relationship between depression and self-care behavior is direct or indirect via the IMB model's information (diabetes knowledge) and motivation (personal: fatalistic attitudes; and social: social support) determinants of behavior and (2) to determine whether the relationship between depression and glycemic control is a direct relationship or indirect relationship via self-care behaviors. The authors hypothesized that among adults with T2DM, depression would be related to self-care behavior via motivation (not information) and that depression would be indirectly related to glycemic control via self-care behavior.

Research Design and Methods

Participants

Consecutive patients with diagnosed T2DM were recruited at scheduled appointments at the Medical University of South Carolina (MUSC) Internal Medicine Clinic, Charleston, South Carolina. The institutional review board at MUSC approved all procedures prior to study enrollment. Eligible participants were clinic patients, aged 18 years or older with a diagnosis of T2DM in the medical record, and a clinic appointment between June and August 2008. Patients were ineligible if they did not speak English or if the research assistants determined (by interaction or chart documentation) they

were too ill or cognitively impaired to participate.

Data and Procedure

Research assistants reviewed the electronic clinic roster daily to identify eligible patients. Eligible patients were approached in the clinic waiting room and provided a description of the study. Those interested and eligible consented and were taken to a private area in the clinic to complete the study instruments. Participants completed the assessment before or after their scheduled clinic appointments, depending on clinic flow. One hundred twenty-six subjects consented and completed all study measures.

Data were collected on self-reported age, sex, race/ethnicity, education, household income, and marital status. Additional measures included validated surveys of depressive symptoms, diabetes knowledge, diabetes fatalism, social support, and diabetes self-care behavior. Hemoglobin A1C values were extracted from the electronic medical records.

Depressive symptoms. Depressive symptoms were assessed with the Patient Health Questionnaire (PHQ-9).²¹ The PHQ-9 has demonstrated usefulness as a screening tool for depression with acceptable reliability, validity, sensitivity, and specificity.²² The 9 items of the PHQ-9 come directly from the 9 *Diagnostic and Statistical Manual of Mental Disorders* (fourth edition) signs and symptoms of major depression.²¹ Higher scores on the PHQ-9 represent more depressive symptomatology with a range of 0 to 27. Depression was treated as a continuous variable but was also categorized as no depression (PHQ-9 score <5), mild depression (PHQ-9 score 5-9), and major depression (PHQ-9 score ≥10) based on established guidelines.²¹

Diabetes knowledge. Diabetes knowledge served as the measure of information and was assessed with the Diabetes Knowledge Questionnaire (DKQ).²³ The DKQ is a valid and reliable measure of diabetes knowledge, with high internal consistency reliability ranging from $\alpha = .73$ to $.83$ and construct validity reported in other studies.²³ The DKQ elicits information about a respondent's understanding of the cause of diabetes, types of diabetes, self-management skills, and complications of diabetes. Responses are graded as "yes," "no," or "don't know."

The final score was based on the percentage of correct scores, with a maximum possible score of 100.

Fatalistic attitudes. Diabetes fatalism served as the measure of personal motivation²⁴ and was assessed with the 18-item Diabetes Fatalism Scale (DFS-18). The DFS-18 has good internal consistency ($\alpha = .73$) and response variability (range, 30-90; mean, 58.2; SD, 6.8). Diabetes fatalism is operationally defined as "a complex psychological cycle characterized by perceptions of despair, hopelessness, and powerlessness." A summary score consisting of the sum of individual items is created, such that higher summary scores represent greater diabetes fatalism.

Social support. Social support served as the measure of social motivation and was assessed with the 19-item Medical Outcomes Study (MOS) Social Support Survey.²⁵ The MOS is a valid and reliable measure of social support that has demonstrated test-retest reliability and internal consistency reliabilities greater 0.91.²⁵ The MOS measures perceived general functional support in 4 domains, including emotional/informational, tangible, positive social interaction, and affection, and yields an overall support index, which was used in the analyses.

Diabetes self-care behavior. Self-care behavior was assessed with the 11-item Summary of Diabetes Self-care Activities (SDSCA) scale.²⁶ The SDSCA measures frequency of self-care activity in the past 7 days for 5 aspects of the diabetes regimen: general diet (followed healthful diet), specific diet (ate fruits/low-fat diet), foot care, blood glucose testing, exercise, and cigarette smoking.

Glycemic control. Patients' most recent hemoglobin A1C value was extracted from the medical record and served as the measure of glycemic control.

Data Analyses

Structural equation models (SEM), specifying the relationships between variables, were estimated using AMOS, version 17. SEM is a statistical approach that is suitable for both theory testing and theory development. It usually starts with a hypothesis that is built around a model. In the model, the constructs of interest are assessed with measurement instruments, and then the fit of the model is tested against the obtained data. Advantages of this procedure include the generality and

flexibility of model specification and the ability to assess fit of the hypothesized model to the observed data.

In a prior analysis with the current sample of diabetes patients, the authors found that a single factor (or latent variable, which the authors are calling “diabetes self-care”) loaded onto the SDSCA’s subscales: specific diet, general diet, foot care, and self-monitoring of blood glucose.²⁷ In that same analyses, the authors also showed that having more information (greater diabetes knowledge), more personal motivation (less diabetes fatalism), and more social motivation (more social support) was associated with the latent variable diabetes self-care behavior; behavior was the sole predictor of glycemic control.²⁷ Those analyses prompted the current analytic approach, which was to explore the role of depression in explaining these relationships.

The current SEM was estimated using AMOS 17.0. The sample size of 126 cases was sufficient for these analyses.^{28,29} Hypotheses regarding the specific structural relations of the constructs in the model were evaluated through inspection of the direction and magnitude of the path coefficients. Consistent with the IMB model assumptions, diabetes knowledge (as a measure of information), fatalistic attitudes (as a measure of personal motivation), and social support (as a measure of social motivation) were hypothesized to predict diabetes self-care behavior, not glycemic control (A1C). Only behavior was predicted to relate to A1C.

The likelihood ratio χ^2 tests are reported, but model fit was primarily evaluated with the comparative fit index (CFI) and root mean square error of approximation (RMSEA).^{30,31} Both the CFI and RMSEA test how well an estimated model fits the data structure. A nonsignificant likelihood ratio χ^2 test suggests that the data fit the model well, while CFI values exceeding 0.90 and RMSEA values less than 0.08 indicate adequate model fit.³²

Results

A total of 126 men and women with T2DM completed all measures noted above. Participants were, on average, 63 years old. Most were female (72.8%), African American (70.2%), not working (80.0%), and insured (96.4%). Also, in this sample, 61.9% had no depression, 23.8% had minor depression, and 14.3% had major depression (see Table 1).

The estimated SEM with parameters and tests of significance of individual paths appears in Figure 1.

Table 1

Sample Demographics (N = 126)

Demographic	Means \pm SD or %
Mean age, y	62.7 \pm 11.8
Age category, y	
18-49	14.3
50-64	34.9
65+	50.8
Female	72.8
Race/ethnicity	
Non-Hispanic white	29.8
Non-Hispanic black	70.2
Mean education, y	12.4 \pm 5.2
Education category	
<High school graduate	34.2
High school graduate	35.0
>High school graduate	30.8
Married	40.6
Employed	20.0
Income category	
<\$10 000	36.8
<\$15 000	28.0
\$15 000+	35.2
Insured	96.4
Health status	
Better than last year	19.2
Worse than last year	24.8
Same as last year	56.0
Depression status	
No depression	61.9
Minor depression	23.8
Major depression	14.3

The estimated model demonstrated good data fit, $\chi^2(23, N = 126) = 19.70, P = .66, CFI = 1.00, RMSEA = 0.00$ (90% CI, 0.00-0.06). When depressive symptoms were accounted for, more diabetes knowledge ($r = 0.21, P = .02$) and more social support ($r = 0.20, P = .04$) remained significantly related to performing diabetes self-care behaviors. Higher levels of depressive symptoms were significantly related to having less

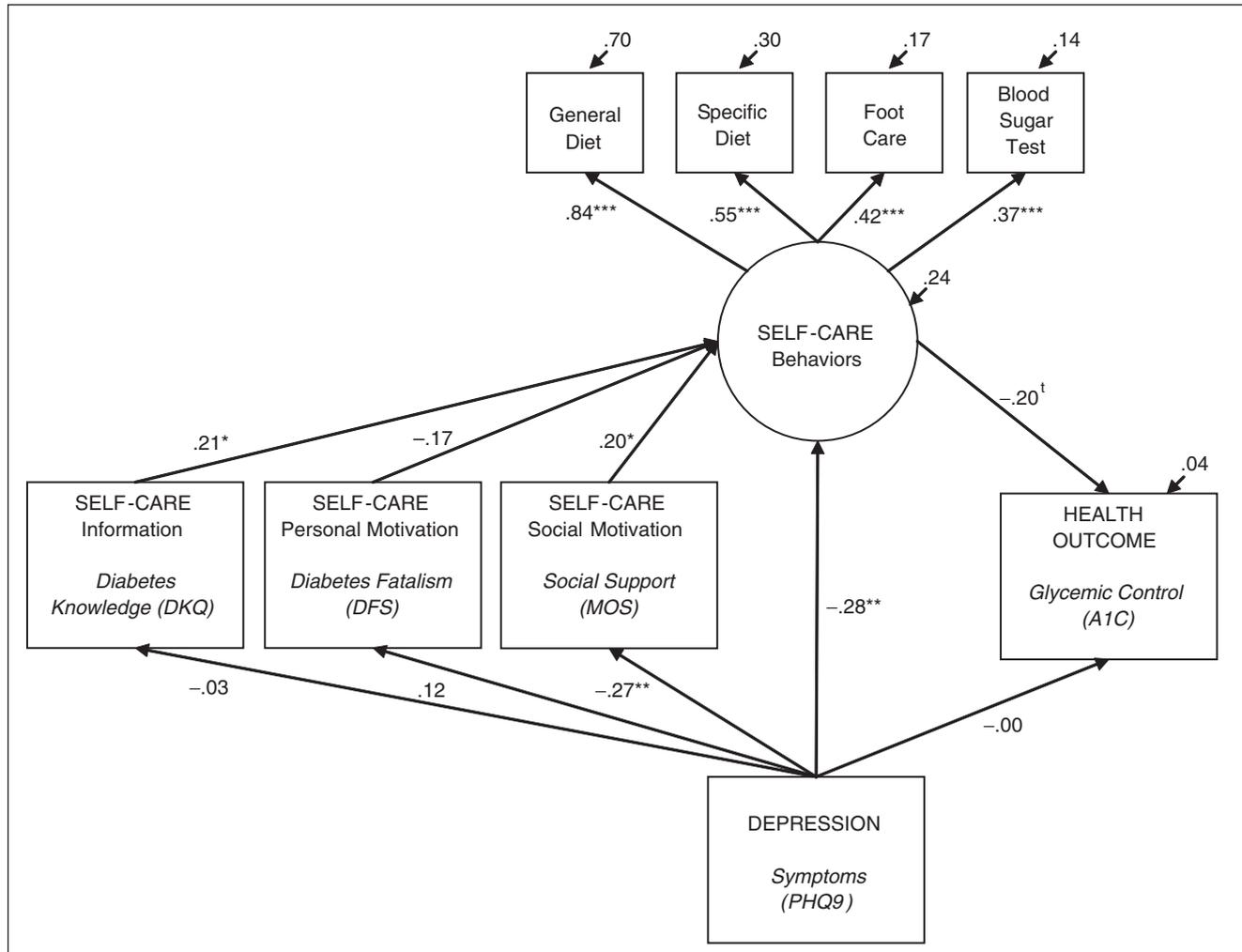


Figure 1. Depressive symptoms and the information-motivation-behavioral skills model of diabetes self-care (full). Coefficients are standardized path coefficients. Overall model fit, $\chi^2(23, N = 126) = 19.70, P = .66$, comparative fit index = 1.00, root mean square error of approximation = 0.00 (90% confidence interval, 0.00-0.06). For tests of significance of individual paths, $^{\dagger}P = .08, *P < .05, **P < .01, and ***P < .001$.

social support ($r = 0.27, P = .002$) and decreased performance of diabetes self-care behaviors ($r = -0.28, P = .004$). In addition, when depressive symptoms were included in the model, fatalistic attitudes were no longer associated with behavioral performance ($r = -0.17, P = ns$). In sum, more diabetes knowledge, more social support, and less depressive symptoms were associated with performing diabetes self-care behaviors, explaining 24% of the variability in the diabetes self-care behaviors score.

In an effort to generate a more parsimonious model, a trimmed version of the above model was estimated. The trimmed model included all significant

paths from the initial model, omitting all nonsignificant paths. The trimmed model with structural parameters and tests of significance of individual paths appears in Figure 2. The estimated model demonstrated good data fit, $\chi^2(18, N = 126) = 18.16, P = .44, CFI = 1.00, RMSEA = 0.01$ (90% CI, 0.00-0.08). The χ^2 difference test between the trimmed and full models, $\chi^2(5, N = 126) = 1.54$, was nonsignificant, permitting the retention of the trimmed version as the final model. In both the full and trimmed models, diabetes self-care behaviors were marginally associated with glycemic control ($r = -0.20, P = .08$, and $r = -0.19, P = .06$, respectively).

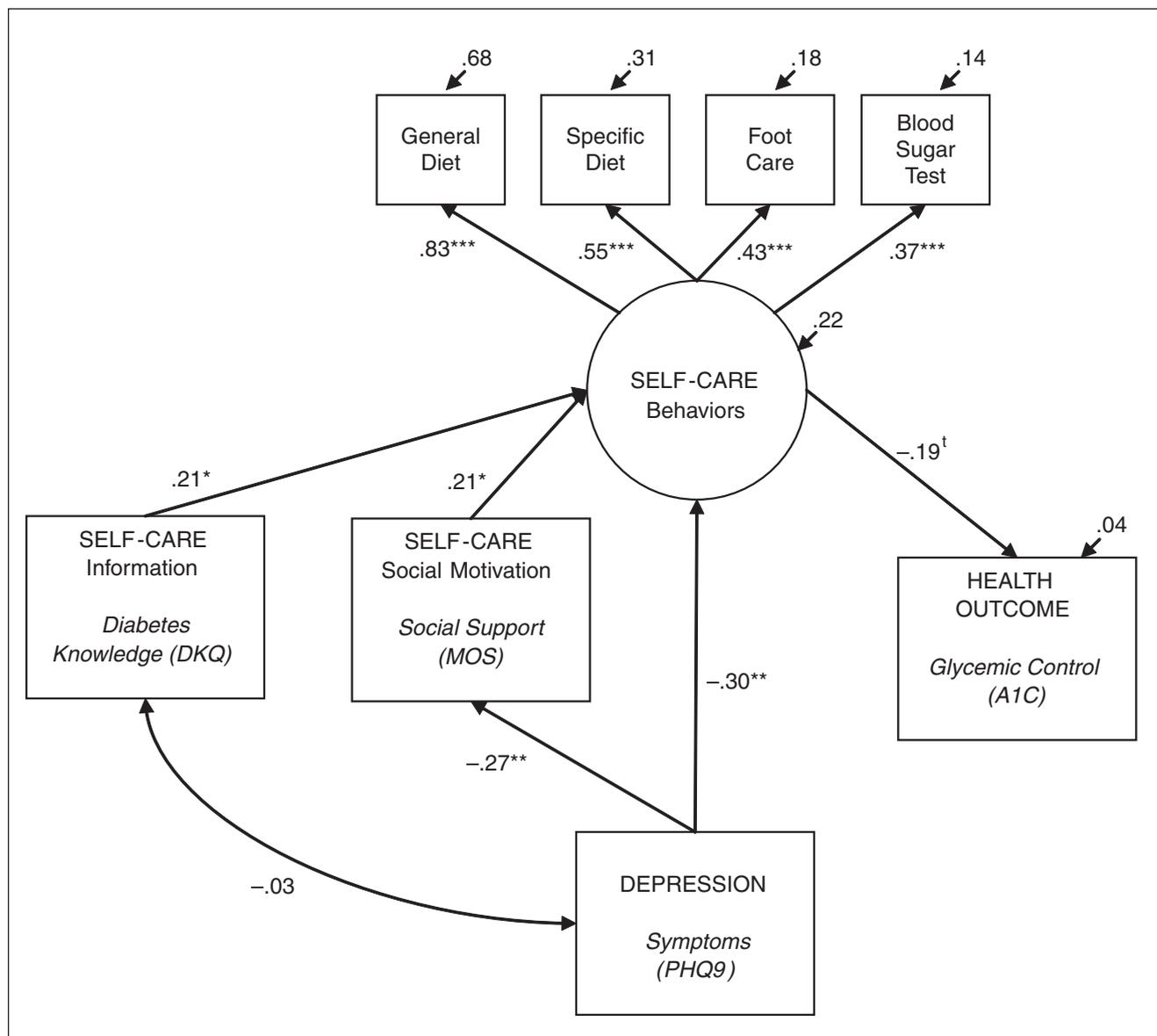


Figure 2. Depressive symptoms and the information-motivation-behavioral skills model of diabetes self-care (trimmed). Coefficients are standardized path coefficients. Overall model fit, $\chi^2(18, N = 126) = 18.16, P = .44$, comparative fit index = 1.00, root mean square error of approximation = 0.01 (90% confidence interval, 0.00-0.08). For tests of significance of individual paths, $^tP = .06, *P < .05, **P < .01, and ***P < .001$.

Discussion

This study shows that in this sample of adults with T2DM, depression does not have a direct effect on glycemic control; rather, the relationship is indirect via self-care behaviors. While there is a direct relationship between depression and behavior, social motivation exists in this predicted pathway and is potentially modifiable through diabetes education efforts. Although prior

studies have documented that depression impairs self-care behaviors,^{13,14,33} this is the first study, to the authors' knowledge, that has taken the next step to examine the direct and indirect relationships among depression, self-care, and glycemic control.

This study adds to the literature in 3 important ways. First, it provides new evidence to support the authors' previously published conceptual model that posits that depression exerts an influence on diabetes-related health

outcomes through decreased motivation to maintain behaviors that are protective against worsening of metabolic control and development of complications. Second, the study uses a previously validated behavioral model, the IMB model, to identify appropriate variables that explain self-care behaviors in people with diabetes (ie, knowledge, personal motivation, and social motivation) that can be addressed in educational efforts. Third, the study provides good evidence that social support is an important contributor to effective self-care behavior in depressed adults with T2DM.

The study has limitations that are worth mentioning. First, the authors were unable to explore the role of other potential moderators (eg, literacy level, race/ethnicity) in the evaluated models because of a restricted sample size. Second, the results speak most clearly to the population under study and needs to be replicated in different patient groups. Third, although the IMB model proposes causal relationships between variables, the current study was cross-sectional in nature and thus can most appropriately speak to associations between constructs observed at a single point in time, not causality. Future research should be conducted to investigate the longitudinal effects of depression on an individual's motivation to perform diabetes self-care behavior over time. In addition, future work should be guided by data that include all the relevant constructs of the IMB model, namely behavioral skills or self-efficacy. This will provide a more comprehensive understanding of the elements that should be incorporated in diabetes self-care interventions, particularly those targeting patients with comorbid depression.

In conclusion, this study supports the hypothesis that among adults with diabetes, depression impedes treatment-seeking behavior, seeking social support, and the adoption of effective self-management behaviors (including physical activity, appropriate dietary behavior, foot care, and appropriate self-monitoring of blood glucose behavior). Additional studies are needed to clarify the role of motivation on the impact of depression on self-care behaviors and glycemic control in adults with diabetes.

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