When Is Social Support Important? The Association of Family Support and Professional Support with Specific Diabetes Self-management Behaviors

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BACKGROUND: Social support is associated with better diabetes self-management behavior (SMB), yet interventions to increase family and friend support (FF support) have had inconsistent effects on SMB.

OBJECTIVE: To test whether FF support differentially affects specific SMBs and compare the influence of support from health professionals and psychological factors on specific SMBs to that of FF support.

DESIGN: Cross-sectional survey of people with diabetes recruited for a self-management intervention

PARTICIPANTS AND SETTING: One hundred sixty-four African-American and Latino adults with diabetes living in inner-city Detroit

MEASUREMENTS AND MAIN RESULTS: For every unit increase in FF support for glucose monitoring, the adjusted odds ratio (AOR) of completing testing as recommended was 1.77 (95% CI 1.21–2.58). FF support was not associated with four other SMBs (taking medicines, following a meal plan, physical activity, checking feet). Support from non-physician health professionals was associated with checking feet [AOR 1.72 (1.07–2.78)] and meal plan adherence [AOR=1.61 (1.11–2.34)]. Diabetes self-efficacy was associated with testing sugar, meal plan adherence, and checking feet. Additional analyses suggested that self-efficacy was mediating the effect of FF support on diet and checking feet, but not the FF support effect on glucose monitoring.

CONCLUSIONS: The association between FF support and SMB performance was stronger for glucose monitoring than for other SMBs. Professional support and diabetes self-efficacy were each independently associated with performance of different SMBs. SMB interventions may need to differentially emphasize FF support, self-efficacy, or professional support depending on the SMB targeted for improvement.

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INTRODUCTION

Patients' diabetes self-management is a key determinant of diabetes outcomes. Self-management tasks, such as glucose testing or insulin injection, often take place in social settings and can alter family and social routines. Patients' family and friends can provide support in overcoming these social barriers and in executing complex self-management behaviors, but can also pose barriers to self-management behaviors. Practical and emotional assistance received in family and friend relationships, or social support, has a positive influence on global measures of diabetes self-management behavior (SMB).^{1–8} However, to date interventions seeking to improve SMB by increasing social support from family and friends (FF support) have had mixed results.^{9,10} In light of increasing calls to involve family in chronic disease care, it is critical to more closely examine the effects of FF support and possible reasons for intervention success or failure.

One hypothesis for inconsistent social support intervention effects is that FF support affects each SMB differently. For example, family support may be more important for SMBs that affect family routines, such as meal planning, or those that take place in social settings, such as glucose testing. Performance of some SMBs may depend on factors external to the family environment, such as neighborhood environment and community resources for healthful eating and physical activity.^{11–15} Patients may receive more support for some SMBs from health professionals, making family support less important for those tasks.¹⁶ Moreover, according to social cognitive theory and social support theory, patient psychological factors may mediate the effect of social support on SMB, and it is possible that these mediators vary in their ability to affect SMB. For instance, social support may improve SMB by first leading to increased self-efficacy^{3,17–19} or decreased depressive symptoms,^{20–23} and self-management tasks that are affected more by these factors²⁴ may be more affected by social support.

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Despite discussion of these possible reasons for support to affect self-management tasks differently,^{4,9} previous studies have not directly compared family support, professional support, and psychological influences across SMB domains. Accordingly, we examined the relationship between perceived family and friend support for each of five specific SMBs (testing sugar, taking diabetes medicines, following a diabetes meal plan, physical activity, and checking feet) and the performance of that behavior, using data from a survey of African-American and Latino adults with diabetes. We then compared the effects of adjusting for professional support, self-efficacy, and depression in each FF support-SMB relationship.

RESEARCH DESIGN AND METHODS

Study Population

We analyzed data from surveys of 164 African-American and Latino adults with type 2 diabetes. The surveys were conducted by the REACH Detroit Partnership, a CDC-funded collaboration of community groups, academic partners, and local health-care providers working to improve diabetes outcomes among African Americans and Latinos in the Eastside and Southwest Detroit communities.^{25,26} The surveys were completed as part of a baseline assessment of participants enrolled in a community-health worker-led diabetes self-management intervention consisting of group self-management training sessions and individual support. Participants were age 18 or older, had physician-diagnosed type 2 diabetes, but no serious diabetes complications, such as blindness, amputation, or kidney failure, and received medical care through a local health system or a federally qualified community-health center. Participants were recruited from health-system diabetes registries. The average annual household income in the three zipcodes with the largest number of participants ranged from \$24,256 to \$25,546 (2000 US Census data).

Of 578 eligible participants, 183 agreed to participate, and 164 completed the full baseline assessment. Latinos were more likely to participate than African-Americans (49.7% vs 26.8%), and the mean age of participants (53.0) was significantly lower than the age for non-participants (58.9). Surveys were conducted in the participant's home in their preferred language (English or Spanish) by a trained African-American or Latino interviewer.

Using a community-based participatory research approach,^{26,27} the REACH Detroit Partnership steering committee was actively involved in the development of the study questions, survey instrument, and methods for data collection, interpretation, and dissemination. The survey protocol received Institutional Review Board approval at the local participating health systems and the University of Michigan.

Study Measures

Sociodemographics were determined through self-report with survey items asking age, gender, education level, and race/ethnicity. *Health Status* was assessed with a question about activity limitations from the Behavioral Risk Factor Surveillance Survey (BRFSS)²⁸ and self-reported diabetes medication regimen (see Appendix for question wording). Participants' A1C levels were obtained from medical chart values closest to the

time of the survey. *Social support* from family and friends (FF support) for each of five SMB tasks was assessed with items from the Diabetes Care Profile,^{29,30} and physician and other health-professional support for diabetes care was assessed with single questions (see Table 1 for question wording). *Diabetes SMBs* were assessed with items from the Survey of Diabetes Self-Care Activities (SDSCA).^{31,32} Physical activity was assessed using questions from the BRFSS.³³ Diabetes care self-efficacy and depressive symptoms were measured with validated survey scales [the Perceived Competence for Diabetes Scale³⁴ and the Patient Health Questionnaire (PHQ-9),³⁵ respectively].

Statistical Analysis

Support for each SMB task was separately regressed onto the performance of the corresponding task in bivariate and multivariate models. Because SMB outcomes were collected in four categories of unequal intervals, they were treated as ordinal variables. Based on response distribution and clinical relevance of cutoff points to diabetes outcomes, taking medicines and checking feet were dichotomized to 7 days/week vs. less than 7 days/week, and testing sugar was dichotomized to 0–1 days/week vs. more than 1 day/week; these three SMBs were analyzed with logistic regression. The even response distribution in diabetes meal plan and physical activity categories allowed us to analyze these outcomes with ordered logistic regression.

The principal independent variables (FF support, professional support, self-efficacy, and depressive symptoms) were measured with Likert scales and had near normal response distributions, so they were treated as continuous variables. Other independent variables were chosen based on theoretical and documented relationships with diabetes SMB and were limited in number by our sample size. They included age, gender, education, and race/ethnicity, medication regimen, and functional limitations. We tested for collinearity by examining bivariate associations of each of these additional independent variables with FF support and professional support using the Student's t-test for continuous variables and Pearson's chi-square test for categorical variables. Income was not used due to the high number of missing responses.

Table 1. Social Support Survey Questions

Question or scale	Answer range
Family and friend diabetes-specific support (FF support)	
Diabetes care profile: 29,30	1–5
“I can count on my family or friends to help and support me a lot with...”	Higher score = more perceived support
- Following my meal plan	
- Taking my medicine	
- Taking care of my feet	
- Getting enough physical activity	
- Testing my sugar	
Professional support	
“You get all the support you need from your doctor”	Five-point disagree-agree scale
	Higher score = more perceived support
“How satisfied are you with support provided by other health professionals (RNs, educators, etc.) in your doctor’s office?”	Five-point scale
	Higher score = more perceived support

Table 2. Characteristics of Study Participants (N=164)

	N(%) or mean (SD)
Gender	
Female	116 (71%)
Age	52.6 (12.3)
Education	
Less than high school	67 (41%)
High school or GED	20 (12%)
More than high school	77 (47%)
Race/ethnicity	
African-American	94 (57%)
Latino/a	70 (43%)
Married or partnered	
Yes	98 (62%)
Live alone	
Yes	79 (48%)
Functional limitations	
Yes	60 (37%)
Time since diabetes diagnosis (years)	8.5 (7.9)
Diabetes medication regimen	
No medications	15 (9%)
Oral medications only	100 (63%)
Insulin $\pm$ oral medications	45 (28%)
A1C (%)	8.5 (2.2)

We tested for interactions between medication type (oral or insulin) and FF medication support, and between functional limitations and FF physical activity support, by evaluating the effect of adding the corresponding interaction terms to the medication and physical activity adherence models.

To illustrate the clinical relevance of differences in FF support, we calculated regression model-based predicted probabilities³⁶ for performance of each self-management task significantly associated with FF support. Predictions were calculated from multivariate models controlled for sociodemographic and health variables for those with the lowest and highest level of FF support.

To compare the independent effect of professional support and psychological factors to that of FF support, these variables were added to the FF support-SMB multivariate models. Psychological factors and professional support were evaluated in separate models due to limitations of sample size. Because psychological factors were hypothesized to mediate the support-SMB relationship, we used the method described by Baron and Kenny³⁷ to assess for signs of mediation. According to this method, the independent variable (FF support) must be significantly associated with the proposed mediator variable (self-efficacy or depressive symptoms), which we tested with multivariate linear regression, adjusted for the same sociodemographic and health variables as SMB models. Then, when the mediator is included in the main analysis, the effect of the independent variable (FF support) on the dependent variable (SMB) should be lessened.

Regression diagnostic procedures yielded no evidence for multicollinearity or influential outliers in any model. Analyses were done with Stata 9.2.³⁸

RESULTS

The mean age of the 164 participants was 52.6 years, the majority (71%) was female, and 59% had at least high school education (Table 2). Participants' were diagnosed with diabetes

an average of 8.5 years previously, and their average A1C was 8.5%. None of the sociodemographic or health status measures in Table 2 were significantly associated with FF support or professional support in bivariate tests.

The mean level of FF support for the SMBs varied from 2.48 out of 5 for physical activity support to 2.79 for diabetes medication support (Table 3). For medically related SMB (testing blood sugar, taking diabetes medications, and checking feet), the majority (67%–84%) reported following doctor recommendations 7 days/week. For lifestyle-related SMB (following a diabetes meal plan, physical activity), full adherence was reported 33–36% of the time.

Associations between FF Support and SMB Task Performance

In model 1, each unit increase in FF support, adjusting for sociodemographic and health factors, increased the adjusted odds ratio (AOR) for testing sugar by 1.77 (95% CI 1.21–2.58), increased the AOR for being in a higher physical activity category by 1.31 (0.98–1.73), and increased the AOR for being in a higher diabetes meal plan adherence category by 1.29 (0.97–1.70) (Table 4, model 1). The predicted probability of testing sugar ranged from 37% for participants with the lowest FF support to 85% with the highest level of FF support. The

Table 3. Support for Diabetes Tasks, Self-Management Behavior, Psychological Factors

Social support	Mean (SD)
Family and friend diabetes support for:	
Testing blood sugar	2.6 (1.2)
Taking diabetes medications	2.8 (1.1)
Physical activity	2.5 (1.1)
Following diabetes meal plan	2.8 (1.1)
Checking feet	2.6 (1.2)
Physician support	2.9 (1.0)
Other health professional support	2.4 (0.9)
Reported diabetes self-management behavior	N (%)
Test blood sugar	
0–1 days/week	54 (33%)
2–3 days/week	18 (11%)
4–6 days/week	16 (10%)
7 days/week	74 (46%)
Take diabetes medications (if on medication regimen)	
0–1 days/week	5 (3%)
2–3 days/week	9 (6%)
4–6 days/week	10 (7%)
7 days/week	124 (84%)
Physical activity	
None	41 (26%)
Some but less than CDC recommendations*	66 (41%)
Meet CDC recommendations	53 (33%)
Follow healthy meal plan	
0–1 days/week	32 (20%)
2–3 days/week	35 (22%)
4–6 days/week	36 (22%)
7 days/week	58 (36%)
Check feet	
0–1 days/week	14 (9%)
2–3 days/week	14 (9%)
4–6 days/week	10 (6%)
7 days/week	125 (77%)
Psychological factors	Mean (SD)
Diabetes self-efficacy	6.8 (2.3)
Depressive symptoms	5.1 (5.1)

*CDC physical activity guidelines: moderate activity $\times$ 30 min at least 5 days/week OR vigorous activity $\times$ 20 min at least 3 days/week

Table 4. Results of Multivariable Logistic Regression Models Evaluating the Association of Family/Friend Support (FF Support), Psychological Factors, and Professional Support with Diabetes Self-Management Behavior Adherence

	Test sugar AOR (95%CI)† per unit scale	Take diabetes medicines§ AOR (95%CI)† per unit scale	Meet CDC activity guidelines AOR (95%CI)‡ per unit scale	Follow meal plan AOR (95%CI)‡ per unit scale	Check feet AOR (95%CI)† per unit scale
Model 1					
FF task-specific support	1.77 (1.21–2.58)*	1.64 Oral (0.95–2.84) 0.47 Insulin (0.18–1.27)	1.31 (0.98–1.73)	1.29 (0.97–1.70)	1.22 (0.89–1.68)
Model 2 – Psychological factors					
FF task-specific support	1.65 (1.11–2.46)*	1.57 Oral (0.91–2.71) 0.40 Insulin (0.14–1.11)	1.3 (0.98–1.75)	1.12 (0.83–1.50)	1.13 (0.81–1.58)
Diabetes self-efficacy	1.33 (1.09–1.63)*	1.19 (0.94–1.52)	0.96 (0.83–1.10)	1.24 (1.07–1.44)*	1.22 (1.02–1.46)*
Depression symptoms	0.92 (0.84–1.02)	0.94 (0.83–1.07)	0.95 (0.88–1.02)	0.92 (0.85–0.99)*	0.95 (0.87–1.04)
Model 3 – Other support sources					
FF task-specific support	1.70 (1.15–2.50)*	1.34 Oral (0.75–2.39) 0.38 Insulin (0.13–1.12)	1.27 (0.94–1.72)	1.42 (1.05–1.93)*	1.20 (0.86–1.69)
Physician support	0.86 (0.54–1.35)	1.45 (0.79–2.66)	0.90 (0.63–1.28)	0.68 (0.48–0.97)*	0.85 (0.54–1.36)
Other professional support	0.97 (0.58–1.61)	0.57 (0.27–1.17)	0.75 (0.51–1.12)	1.61 (1.11–2.34)*	1.72 (1.07–2.78)*

*CI does not cross 1

Model 1: Adjusted for demographics (gender, education, age, and race/ethnicity), health factors (medication regimen, functional limitations), and family/friend task support (1–5 scale)

Model 2: Model 1 + Self-Efficacy (0–10 scale) + Depression Symptoms (0–27 scale, higher score=higher depression severity)

Model 3: Model 1 + Physician Support (1–5 scale) + Other Professional Support (1–5 scale)

†AOR obtained with logistic regression

§AOR obtained with ordered logistic regression

‡All models for taking medicines excluded participants not on a diabetes medication regimen (model N 139) and included the interaction term medication regimen × FF support

interaction term was significantly positively associated with medication taking in all medication models, indicating that the association of FF support was greater with taking oral medications.

The interaction term of FF physical activity support × functional limitations was not significant when added to physical activity models.

Additional Analyses

Multivariate linear regressions, adjusted for sociodemographic and health factors, showed that FF support had a positive association with self-efficacy for testing sugar (coefficient 0.36, $p=0.03$), following a diabetes meal plan (coefficient 0.37, $p=0.04$), and checking feet (coefficient 0.32, $p=0.04$) (data not shown in tables). There were no significant associations between any type of FF support and depressive symptoms. When psychological factors were added to multivariate models predicting SMB performance (model 2 in Table 4), self-efficacy was associated with testing sugar, following a diabetes meal plan, and checking feet, while greater depressive symptom severity was associated with lower adherence to a diabetes meal plan. The relationship between FF support for testing sugar and performance of testing sugar remained significant and did not decrease when psychological factors were added. However, in the models predicting following a diabetes meal plan and checking feet, the AOR of FF support decreased from model 1 to model 2 when psychological factors were added.

When we added professional support for diabetes care to multivariate models of SMB performance (model 3 in Table 4), professional support from non-physicians was associated with

increased diabetes meal plan and checking feet adherence. In contrast, increased physician support was associated with decreased diabetes meal plan adherence. Of note, the relationship between FF support and adherence to a diabetes meal plan became statistically significant after adjusting for professional support.

DISCUSSION

In adjusted analyses in our sample of urban African-American and Latino adults with diabetes, social support from family and friends was positively associated with testing sugar and with following a diabetes meal plan when adjusted for professional support, but was not significantly associated with other SMBs tested. FF support had a significantly more positive effect on taking oral medications than on taking insulin. Self-efficacy was significantly associated with testing sugar, following a diabetes meal plan, and checking feet, while depressive symptoms were significantly associated with diabetes meal plan adherence only. Additional analyses suggested that self-efficacy could be mediating the effect of FF support on diabetes meal plan adherence and checking feet. Support from non-physician health professionals was positively associated with following a diabetes meal plan and checking feet, while support from physicians was negatively associated with diabetes meal plan adherence. This study is the most detailed and comprehensive evaluation of the disease-specific family support-SMB relationship that we are aware of, as we examined the relationship of support to a wide variety of SMBs, compared the effects of family support with professional support on

specific SMBs, and compared the effects of psychological factors and family support on SMB.

Our study builds on the findings of two prior studies on the association of disease support with specific SMBs. Bailey and colleagues³⁹ found unadjusted correlations between overall diabetes social support and diet and exercise, but not with medications or testing sugar in 104 predominantly white participants. Shaw and colleagues¹⁵ study of 208 participants, 57% of whom were white, found that family and friend support was associated with diet and foot care, but not physical activity or testing sugar, after adjusting for age, gender, and education. Our study assessed a wider range of SMBs than prior studies, analyzed differences in support effects on oral medications vs. insulin, and included additional potential confounders such as participants' medication regimen and functional status. In this study three SMBs (taking medications, following a diabetes meal plan, and physical activity) had associations with FF support that were close to statistically significant. Given these results, it is possible that FF support had an effect on these SMBs that we were underpowered to detect at 95% confidence levels, but it is also possible that the FF support-SMB relationship for these SMBs did not vary in our participants.

Our findings add valuable knowledge about FF support in African-American and Latino adults with diabetes. Adherence to SMB recommendations, such as testing sugar, diet plans, and checking feet, have been found to be lower in African-Americans and Latinos,⁴⁰⁻⁴³ and factors such as family characteristics and cultural food practices have been shown to affect SMB in African-Americans and Latinos more than non-Hispanic whites.⁴⁴⁻⁴⁶ When comparing the effect of support on SMB in white and African-American patients,^{39,47} Bailey and colleagues found that support had stronger associations with SMB in African-Americans, while Fitzgerald and colleagues found that support mattered more to diet adherence in whites than African-Americans with diabetes. Studies with African-American⁴⁸⁻⁵⁰ or Latino⁵¹⁻⁵³ participants have had conflicting results on whether social support is related to global measures of diabetes SMB. Our finding that social support is related to some SMBs and not others in these groups could help to explain these disparate findings and adds evidence that SMB interventions with African Americans and Latinos should consider the varying effects of social support on specific SMBs. We are not aware of any studies that directly compare the effects of social support in African-Americans and Latinos.

We analyzed two factors that could affect the FF support-SMB relationship. First, we examined psychological mediators of the FF support-SMB relationship and found that self-efficacy and depressive symptoms did not show signs of mediating the association between testing sugar and FF support. However, we found evidence that self-efficacy could mediate the association of FF support with diabetes meal plan adherence and checking feet. We noted a pattern of independent relationships between self-efficacy and SMB similar to that found by others,²⁴ but we know of no other study looking simultaneously at FF support and self-efficacy with specific SMBs. It is possible that social support may affect some SMBs by increasing self-efficacy, while self-efficacy and support may act independently on other SMBs; this could be further tested in a prospective analysis.

Second, we tested the effect of professional support on the FF support-SMB relationship, finding that non-physician

professional support was most strongly associated with tasks that had no significant relationship with FF support: checking feet and diabetes meal plan adherence. Past research has shown that certain provider communication styles are more influential on some SMB than others.⁵⁴ Our findings could reflect the ability of professionals to give more effective support for tasks that require specialized or complex knowledge. Alternatively, when support from one source is ineffectual at supporting a task, patients may look to alternate support sources for that task. Interestingly, physician support was negatively associated with meal plan adherence, while non-physician support was positively associated. While it is possible that physician support is detrimental to those trying to follow a meal plan or that non-physician professionals are more effective at supporting healthy eating, it is also possible that people who have more severe diabetes or who are not doing well with their meal plan require more attention from their physician providers.

There are other factors that could explain differences in FF support effects on SMBs. The quality of family support for various tasks needs to be evaluated. For example, families may have more accurate knowledge of — and confidence in — providing support for a simpler task like testing sugar than a more complex task like following a diabetes meal plan. In addition, the influence of factors external to the family on the ability for support to affect SMB needs to be evaluated. For example, the availability of medical supplies, healthy food, and exercise facilities may influence the ability of patients to 'act on' support from others,¹¹⁻¹⁴ and these barriers are perceived as common in Detroit and other urban communities.^{27,55}

This study has several limitations. First, our small sample size may have been underpowered to detect some statistically significant support-SMB associations. Our sample size also limited our ability to include more correlates of SMB in our models, such as comorbidities and cognitive function, although other measures of health status and functional status were included. Second, our participants were urban-dwelling, minority race or ethnicity, and were predominantly female, so these results may not be generalizable to other patient populations. The low response rate among African-Americans may have biased our sample and further limited generalizability. Third, it has been well documented that self-report of SMB leads to over-reporting of adherence,⁵⁶⁻⁵⁸ although we relied on categories of adherence whose distribution probably still reflects the relative level of adherence between groups. Fourth, this study examines only perceived disease-specific support and does not distinguish between recognized types of support (such as instrumental, emotional, and informational) or between support from family versus friends. Since it appears that different types of support are important for different SMBs, future studies of social support and SMB should measure these specific types of support. Finally, cross-sectional data make it impossible to assess causality, as it is possible that FF support could be increased *in response* to more intensive SMB needs. Longitudinal analyses in progress could clarify the cause and effect relationship between support and SMB in this sample.

Despite these limitations, our findings have important implications for future diabetes self-management research and interventions. Future studies of social support and SMB should examine effects on each SMB separately. Studies need to move beyond assessing *whether* support affects SMB and

focus on *how* support affects SMB, by examining moderators and mediators of the support-SMB relationship. SMB interventions might be improved by focusing on FF support or professional support for those SMBs that are most influenced by such support. Alternatively, interventions could attempt to increase the quality of social support for those behaviors currently not influenced by social support. Our results further suggest that interventions could affect some SMB by directly increasing self-efficacy, but in other cases intervening on both FF support and self-efficacy could be necessary.

In conclusion, in this group of urban African-American and Latino people with diabetes, diabetes-specific social support from family and friends was associated with different self-management behaviors than support from health professionals, and self-efficacy may have mediated the effect of support on some SMBs more than others. Prospective studies that assess the effects of social support with its mediators and moderators on diabetes self-management behaviors are a key next step in understanding the importance of social support to SMB. Communities and researchers working in partnership to improve diabetes SMB need to consider the effects of — and how best to mobilize — social support for specific SMBs in the design, implementation, and evaluation of their interventions.

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APPENDIX

Survey questions

Sociodemographics	
Gender/sex	Male or female
Age	Calculated from date of birth (DOB)
Race/ethnicity	
What is the ethnic origin/race that you identify most with?	-White
Check only one	-Black
	-Hispanic/Latino
	-Native American
	-Asian or Pacific Islander
	-Arabic
	-Other (please specify)
Education:	
What is the highest level of education you completed?	-Less than high school
Check only one answer	-High school graduate
	-Technical school
	-Some college
	-Two-year college (Associate's degree)
	-Four-year college (Bachelor's degree)
	-Graduate school (Master's or Doctorate)
	-Other
Health status	
Functional status:	Yes or no
Are you limited in any way in activities because of physical, mental, or emotional problems?	
Diabetes medication regimen:	Yes or no
- Are you taking diabetes pills?	
- Are you taking insulin?	
Self-management behavior (SMB):	
Survey of Diabetes Self-Care activities ^{31, 32}	Days per week
On how many of the last 7 days did you:	
- Take your recommended insulin dose or number of diabetes pills?	
- Follow a healthful eating plan?	
- Test your blood sugar at least as often as your doctor has recommended?	
- Check your feet?	
Physical Activity:	Whether meet CDC physical activity guidelines:
Behavioral Risk Factor Surveillance Survey (BRFSS)	moderate activity × 30 min at least 5 days/week OR vigorous activity × 20 min at least 3 days/week
Psychological factors	
Diabetes self-efficacy:	Five-point agree-disagree
Perceived Competence for Diabetes Scale ³⁴ :	Total scaled to 0–10
- You feel confident in your ability to manage your diabetes	Higher score = higher self-efficacy
- You feel capable of handling your diabetes now	
- You are able to do your own routine diabetes care now	
- You are able to meet the challenge of controlling your diabetes	

(continued on next page)

(continued)

Survey questions

Depressive symptoms: Patient Health Questionnaire (PHQ-9)³⁵: 0-27
Higher score = more depression symptoms

How often have you been bothered by each of the following symptoms during the past 2 weeks?

- Feeling down, depressed, or hopeless?
 - Little interest or pleasure in doing things?
 - Trouble falling or staying asleep, or sleeping too much?
 - Feeling tired or having little energy?
 - Poor appetite or overeating?
 - Feeling bad about yourself - or that you are a failure or have let yourself or your family down?
 - Trouble concentrating on things, such as reading the newspaper or watching television?
 - Moving or speaking so slowly that other people noticed? Or the opposite - being so fidgety or restless that you moved around a lot more than usual?
 - Thoughts that you would be better off dead or of hurting yourself in some way?
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