Predictors of Self-care Behavior in Adults With Type 2 Diabetes: An RRNeST Study

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Background and Objectives: *Four factors have been linked with self-care behaviors in patients with type 2 diabetes: (1) patient demographics, (2) doctor-patient relationship, (3) stress, and (4) social context. This study determined the relationship of each of these factors on self-care behavior in diabetic family practice patients.* Methods: *We conducted a cross-sectional survey of patients seeking care in the outpatient clinics of the Residency Research Network of South Texas (RRNeST), a network of six family practice residency programs affiliated with the University of Texas Health Science Center at San Antonio. A total of 397 consecutive adults with type 2 diabetes presenting for appointments with family medicine faculty and family practice residents over a 6-month time period were surveyed about various factors and their relationship to self-care behavior pertinent to diabetes.* Results: *Self-care was related to age, patient satisfaction with his/her doctor-patient relationship, personal stress, and family context. Social context, as reflected by the statement "My family understands my diabetes," was strongly associated with diet, exercise, and medication adherence. Multivariate analysis demonstrated that, after controlling for patient demographic characteristics and patient satisfaction, personal stress and social context were strongly associated with self-care, especially diet.* Conclusions: *Social context, specifically the family, is significantly associated with self-care behaviors. Attempts to improve self-care behavior should include the family members of the diabetic patient. Since family physicians often provide care to multiple members of the family, they are ideally positioned to implement these interventions.*

Successful management of patients with type 2 diabetes depends heavily on the patients' response to the knowledge they have of the disease, their awareness of its implications, and their subsequent health behaviors, especially self-care behaviors such as diet, exercise, and weight loss.[1] Over the last 20 years, trends in self-care interventions have evolved from "education only" to "education plus behavioral models."[2] Prior studies suggest that enhanced self-care improves glycemic control and healing.[3] Thus, our ability to understand and influence individual behaviors that enhance self-care may significantly influence the success of treatment for patients with diabetes.

Four factors have been linked to successful self-care behaviors of patients with type 2 diabetes. These factors are (1) patient characteristics, (2) doctor-patient relationship, (3) psychological stress, and (4) social context.[4-6] Previous studies of self-care behaviors have often focused on one or two of these factors, such as patient characteristics and psychological stress[7] or the social context.[8]

This study determined the relationship between each of these factors with self-care behavior in patients with type 2 diabetes.

Methods

Setting

The Residency Research Network of South Texas (RRNeST) consists of six family health centers at family practice residency programs affiliated with the University of Texas Health Science Center at San Antonio. These six programs represent approximately 44 family medicine faculty and 130 family practice residents.

The programs are located in five cities across South Texas: two are in San Antonio, and one each are located in Corpus Christi, McAllen, Harlingen, and Laredo. San Antonio and Corpus Christi are larger communities located 100 to 150 miles from the Texas-

Mexico border, while McAllen, Harlingen, and Laredo are situated on the border. Approximately 80% of the patients seen in the six family health centers are Mexican-American.

Participants

Patients were eligible for the study if they had an established diagnosis of type 2 diabetes for 1 year or more and had been attending the same clinic for 1 year or more. Patients were excluded if they were under the age of 18 or pregnant or if their doctor was a first-year resident.

Measurements

We designed a 60-item survey instrument in both English and Spanish versions. The survey included items about patients' demographics, satisfaction with their diabetes care, general health status, self-care behaviors, and barriers to care of diabetes.

Dependent Variables. Four items on the survey represented the dependent variables related to self-care practices for diet, glucose monitoring, adherence to medication regimens, and exercise. The items related to diet, glucose monitoring, and medication requested patients to respond "often," "sometimes," or "never" to each of the following statements: (1) I forget to test my blood sugar at home. (2) I forget to take my diabetes medicine. (3) I follow a diabetic diet. The items related to exercise asked patients to respond yes or no to the statement, "I exercise as my doctor told me to." Each item was subsequently coded again to reflect frequent, occasional, or rare attention to self-care behaviors.

Independent Variables. Table 1 displays four groups of independent variables: demographics, doctor-patient relationship, personal stress, and social context. The doctor-patient relationship was measured with a five-item patient satisfaction scale derived from the American Diabetes Association's Provider Recognition Award patient survey.[1] Patients could respond to each of these items using a five-point scale, ranging from very happy to very unhappy. We derived a global patient satisfaction score by averaging patients' responses to each of the five items. As shown in Table 1, personal stress was measured with three items. Patient could respond to these items with responses of "often," "sometimes," or "never." Finally, the social context of diabetes was addressed with one item, "My family understands my diabetes," to which patients could respond "often," "sometimes," or "never."

Procedure

Office staff or physicians in each practice screened consecutive patients for eligibility for the study and invited those who met the inclusion criteria to com-

Table 1

Independent Variables

Demographic variables
- Age
- Gender
- Race/ethnicity
- Education
- Marital status
- Health insurance

Doctor-patient relationship
- "How happy are you with:
    . . . your diabetes care overall?"
    . . . getting your questions on diabetes answered?"
    . . . getting in touch with your doctor during an emergency?"
    . . . the way your doctor talks to you?"

Personal stress
- "My life is out of control because of my diabetes."
- "I have other illnesses more serious than my diabetes."
- "I have other concerns in my life more serious than my diabetes."

Social context
- "My family understands my diabetes."

plete the survey. Recruitment continued for 6 months, seeking approximately 100 eligible patients from each clinic or 10 patients of 10 physicians.

Analysis

We used Pearson's chi-square tests to measure the statistical significance of association between self-care behaviors (outcomes) and the following dichotomous demographic variables: gender, Hispanic ethnicity, high school education, living with a life partner, having health insurance, and preference for Spanish or English survey. One-way ANOVA were calculated to assess differences in the mean age and patient satisfaction scores between groups defined as those who reported rare, occasional, or frequent self-care behaviors. Mantel-Haenszel chi-square tested associations between self-care behaviors and personal stress and family context items. Alpha was set at $P<.05$. Finally, to assess the multivariable influence of demographics, doctor-patient relationship, personal stress, and social context on the four self-care behavior outcomes, we used STATA® software to conduct four ordinal regression analyses using the proportional-odds model. In these analyses, demographic variables were entered into the equations first, followed by doctor-patient relationship, personal stress, and social context.

Results

A total of 397 patients completed surveys between November 1999 and April 2000 (Table 2). Each site returned an average of 66 surveys, with a range of 9 to

Table 2

Study Subjects' Demographics

Mean age (SD)	56.2 (12.4)
Female (%)	68.7
Prefer Spanish survey (%)	17.9
High school education (%)	50.0
Married (%)	54.4
No health insurance (%)	40.1

SD—standard deviation

121 surveys per clinic. Seventy-six physicians were represented by these 397 patients, for an average of 5.22 patients per physician.

Patient responses to items regarding self-care behavior for diet, exercise, medication adherence, and glucose self-testing are displayed in Figure 1. Patients had the least difficulty with medication adherence; only 3.3% reported rare attention to taking diabetes medicines. On the other hand, many patients reported difficulty with exercise adherence; one third reported rare attention to exercise. In comparison, only 11.1% of patients reported rare attention to diet, and only 14.2% reported rare attention to glucose self-monitoring; the majority of patients reported at least occasional attention to diet and glucose monitoring.

Demographic Predictors

When we compared seven patient demographic characteristics to self-care activity, we found only a few significant associations (Table 3). Age was associated with glucose monitoring and taking diabetic medicines; older people were more likely to remember to do these activities. Gender was also related to exercise; males were significantly more likely to report that they exercised as instructed by their doctor. In addition, insurance status was related to exercise; uninsured patients were more likely than those with health insurance to exercise as instructed.

Doctor-Patient Relationship

Our analysis of the association between the doctor-patient relationship and self-care outcomes, using the global satisfaction

score, revealed that satisfaction was significantly related to diet. Specifically, satisfied patients were more likely to follow a diabetic diet. No other self-care behavior was related to the global satisfaction score.

When we compared self-care behaviors with the individual patient satisfaction items, we found that three of five items had a significant relationship with diet. Further, the item, "How happy are you with your diabetes care overall?" was significantly associated with three of four self-care behaviors: taking medicine (P=.003), following a diabetic diet (P=.000), and glucose self-monitoring (P=.016) (Figure 2). Satisfaction was positively related to self-care behaviors.

Personal Stress

Patients' responses to the stress questions were most strongly related to diet and exercise. If patients reported, "My life is out of control because of my diabetes," or "I have other problems more serious than diabetes," they were less likely to report attention to diet or exercise (Mantel-Haenszel chi-square, P<.05)

Social Context

Social context was significantly associated with three out of the four self-care behaviors. Patients who responded, "My family understands my diabetes" were significantly more likely to report attention to medicines, exercise, and diet (Figure 3).
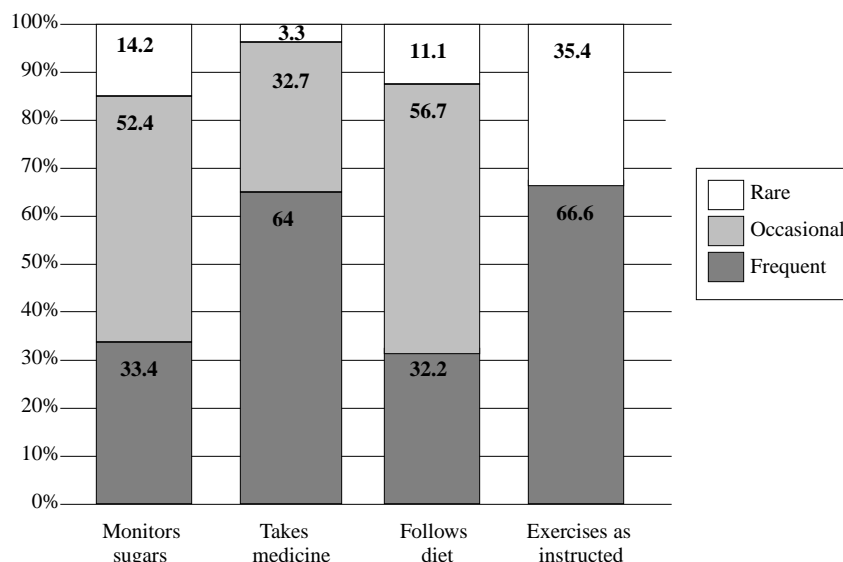
Figure 1

Self-care Behaviors

Table 3

Bivariate Associations Between Predictor Variables and Self-care Outcomes

	OUTCOMES			
PREDICTORS	*Test Glucose*	*Take Medicine*	*Exercise*	*Diet*
Demographics				
Age[a]	F=3.117, P=.046	F=7.275, P=.001	ns	ns
Gender[b]	ns	ns	X^2=3.880, P=.049	ns
Hispanic[b]	ns	ns	ns	ns
High school[b]	ns	ns	ns	ns
With life partner[b]	ns	ns	ns	ns
Health insurance[b]	ns	ns	X^2=5.700, P=.017	ns
Language[b]	ns	ns	ns	ns
Doctor-patient relationship				
Global patient satisfaction[a]	ns	ns	ns	F=5.589, P=.004
1–with diabetes care overall[a]	F=4.162, P=.016	F=5.790, P=.003	ns	F=8.790, P=.000
2–with answers to questions[a]	ns	ns	ns	F=5.425, P=.005
3–with availability during emergency[a]	ns	ns	ns	ns
4–understand lab results[a]	ns	ns	ns	ns
5–with way doctor talks to you[a]	ns	ns	ns	F=5.589, P=.004
Personal stress				
My life is out of control because of diabetes.[c]	ns	ns	X^2=4.476, P=.034	X^2=7.743, P=.005
I have other illness more serious than DM.[c]	ns	ns	ns	ns
I have other problems more serious than DM.[c]	ns	ns	X^2=4.971, P=.026	X^2=8.013, P=.005
Social context				
Family understands diabetes.[c]	ns	X^2=6.122 , P=.13	X^2=5.798, P=.016	X^2=10.870, P=.001

DM—diabetes mellitus

[a] Assessed with one-way ANOVA
[b] Assessed with Pearson's chi-square
[c] Assessed with Mantel-Haenszel chi-square

Multivariate Analysis

The four ordinal regression analyses used proportional odds models to assess predictors of the four self-care outcomes (Table 4). The first two analyses demonstrated weak associations between outcomes and predictors. The model assessing predictors of glucose monitoring was not significant (P=.352), and, within the model, only age was a significant predictor (P=.033). The model assessing predictors of medication compliance was not significant (P=.099), although within the model, age and the social context (family) variable remained significant (P=.044 and .035, respectively). When doctor-patient relationship and personal stress variables were dropped from this model, the linear combination of demographics and social context significantly predicted medication compliance (P=.049), with P=.017 for both of the individual items, age and social context (family).

The models predicting exercise and diet were stronger and significant (Table 4). Having no health insurance and an understanding family predicted compliance with exercise. Male gender and non-Hispanic ethnicity had a weak relationship (P=.064) with exercise as well. The diet outcome had no demographic predictors; the strongest predictor was supportive social context (family), while patient satisfaction and personal stress had a weaker influence (P<.065). Across all four outcomes, older age and supportive social context appeared to demonstrate the most consistent influence on self-care behavior.

Discussion

The results of this study suggest that diabetes self-care is associated with age, patient satisfaction, personal stress, and family context. Diet, in particular, is influenced by interactions with people—physicians and family—and by personal stress. However, social context as reflected in the level of family understanding of diabetes was significantly associated with three out of the four self-care behaviors, even after adjusting for demographics, doctor-patient relationship, and levels of perceived stress.

How are we to interpret these findings? It might be helpful to consider them in the context of a conceptual model or theory that has proven useful in understanding health-related behaviors. Social cognitive theory

(SCT) provides a lens through which one might examine our findings.[9] At the heart of SCT is the concept of reciprocal determinism, a concept suggesting that behavior is dynamic and dependent on both the individual and the individual's environment. In fact, there is continuous interaction between characteristics of the individual, the environment, and the behavior itself. A change in one component will affect the other two.

According to SCT, habitual patterns of interaction between family members constitute an important aspect of the environmental component.[10] In our study, the level of family understanding of diabetes may be a measure of the family interaction pattern that predicts self-care behavior. This finding is consistent with other studies regarding the importance of the family in understanding self-care behaviors among diabetic patients. For example, spouse/partner involvement in care, diet control, and health managerial behavior can supplement and/or replace efforts of the individual patient to self-manage his/her diabetes.[11] Some studies have suggested that a spouse's belief in the importance of diabetic control may be a better predictor of outcomes than the patient's belief.[12] Wang et al found that patients who had family plus friend support had significantly higher universal self-care scores, compared with those without support.[13] Finally, Brown and Hanis found that diabetes education intervention in a rural Texas-Mexico border community that included a family member garnered statistically significant improvements in diabetes knowledge, fasting blood sugar levels, and glycosolated hemoglobin levels.[14]

In SCT, an individual's perception of his/her environment is defined as the "situation" and is known to be an important component in understanding health-related behavior. This perception of the external environment is reflected in the questions regarding psychosocial stress: "My life is out of control because of my

Figure 2

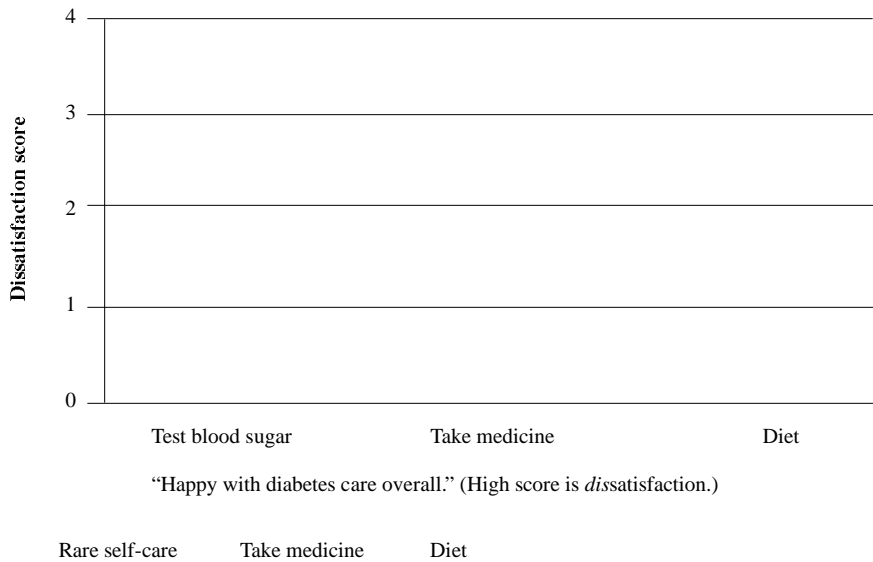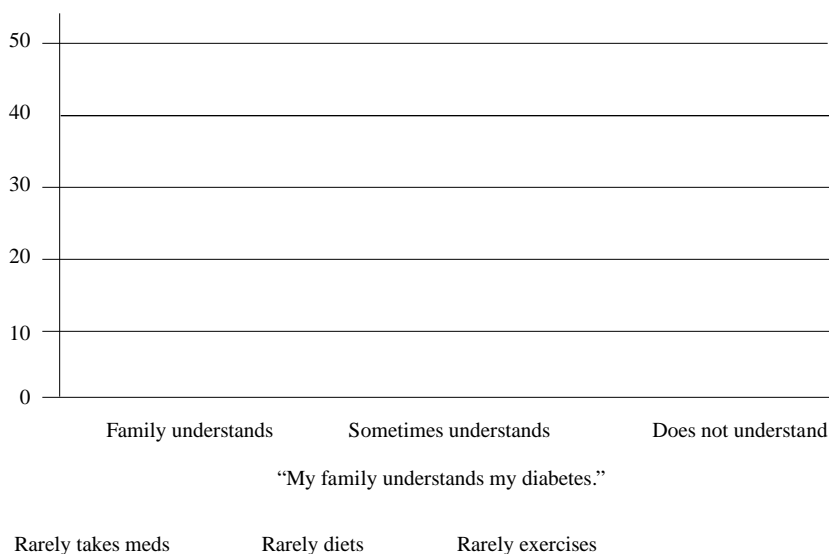Relationship Between Patient Satisfaction and Self-care Outcomes

"Happy with diabetes care overall." (High score is *dis*satisfaction.)

Rare self-care   Take medicine   Diet

Figure 3

Relationship Between Family Context and Poor Self-care

"My family understands my diabetes."

Rarely takes meds   Rarely diets   Rarely exercises

diabetes," and "I have other problems more serious than diabetes." Both of these items were related to diet and exercise behaviors.

Another important construct within SCT is reinforcement. A positive reinforcement is any response to a person's behavior that increases the likelihood that the behavior will be repeated. Thus, receiving praise or congratulations from a respected authority figure, such as a physician, might be considered positive reinforcement. Our study suggests that patients who get their questions answered, and who are satisfied with the way their doctor talks to them, are more likely to adhere to a diabetic diet. It is possible that this finding reflects the influence of positive reinforcement for this behavior.

Limitations

Several limitations of this study deserve mention. First, we relied on patients' self-reports on single-item measures. Patients are likely to report socially desirable behavior, and their adherence to self-care is probably inflated here. Likewise, single item measures tend to have lower levels of reliability. However, these items are part of larger subscales that have respectable levels of internal consistency, lending support to the reliability and validity of these items (unpublished data). Nonetheless, this study could be strengthened by more careful measurement of patients' self-care behaviors. Future studies should incorporate multi-item measures of self-care behaviors and triangulate various methods of measurement to avoid the limitations observed here.

An additional limitation to this study is that the patient population included a large representation of Mexican-American subjects, thus limiting the generalizability of the findings to non-Hispanic populations. This limitation, however, is also a major strength. It is critical that we expand our understanding of diabetes self-care behaviors in the Mexican-American population. Mexican-Americans have a higher prevalence of type 2 diabetes and are more likely to experience diabetic complications.[16] Thus, the burden of diabetes on this population is high. Any advancement in our understanding of barriers to self-care behaviors will inform our approach to designing interventions that are more appropriate for this group.

Table 4

Multivariable Associations Between Predictor Variables and Self-Care Outcomes

	OUTCOMES			
PREDICTORS	*Test Glucose*	*Take Medicine*	*Exercise*	*Diet*
Demographics				
Age	Est=.03 (.01)*, *P*=.033	Est=.03 (.01), *P*=.044	Est=-.01 (.01), ns	Est=-.01 (.01), ns
Gender	Est=.03 (.29), ns	Est=-.02 (.31), ns	Est=-.61 (.33), *P*=.064	Est=.02 (.28), ns
Hispanic	Est=.21 (.38), ns	Est=.08 (.42), ns	Est=-.81 (.44), *P* =.064	Est=.23 (.37), ns
High school	Est=-.16 (.33), ns	Est=-.14 (.34), ns	Est=-.47 (.36), ns	Est=.53 (.32), ns
With life partner	Est=.44 (.28), ns	Est=-.07 (.30), ns	Est=.46 (.31), ns	Est=-.13 (.28), ns
Health insurance	Est=-.59 (.33), *P*=.074	Est=-.27 (.36), ns	Est=-.91 (.40), *P*=.024	Est=.50 (.33), ns
Language	Est=-.41 (.41), ns	Est=-.14 (.45), ns	Est=.69 (.46), ns	Est=.22 (.40), ns
Doctor-patient relationship				
Global patient satisfaction	Est=-.12 (.21), ns	Est=-.29 (.24), ns	Est=.25 (.24), ns	Est=.41 (.22), *P*=.063
Personal stress				
My life is out of control because of diabetes.	Est=-.13 (.22), ns	Est=.09 (.24), ns	Est=.26 (.25), ns	Est=-.41 (.22), *P*=.064
I have other illness more serious than DM.	Est=-.21 (.20), ns	Est=-.29 (.23), ns	Est=-.16 (.24), ns	Est=.30 (.21), ns
I have other problems more serious than DM.	Est=.12 (.22), ns	Est=-.06 (.24), ns	Est=.40 (.25), ns	Est=-.28 (.22), ns
Social context				
My family understands my diabetes.	Est=-.08 (.20), ns	Est=-.45 (.21), *P*=.035	Est=-.43 (.22), *P*=.047	Est=.52 (.20), *P*=.011
Model fitting information	*P*=.352	*P*=.099	*P*=.005	*P*=.004

Est—Estimate and (standard error of the estimate)

DM—diabetes mellitus

Conclusions

We believe one of the most noteworthy findings of our study is that the context of the family is an important determinant of diabetes self-care behaviors. The importance of family context suggests that family physicians, who spend considerable time addressing family issues,[17] are well positioned to improve family understanding of diabetes and thereby the success of diabetes care they provide to patients and their families.

Future efforts to improve self-care behaviors in patients with type 2 diabetes need to consider the importance of including family members and significant others and also on reducing overall stress. In fact, enhancement of family understanding and interactions may be a stress relief to the patient, in and of itself. These efforts might include activities such as inviting family members to participate in office visits by patients with type 2 diabetes. Diabetic education classes, including shopping, cooking, and exercise instruction, might be designed so they focus on the family as the unit of intervention rather than the patient alone. Patient education material for type 2 diabetes could be addressed to family members and not just to patients. Finally, patients with, and particularly without, immediate family can be encouraged to involve a close friend in their educational and self-care efforts.

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