Family Environment, Glycemic Control, and the Psychosocial Adaptation of Adults With Diabetes

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OBJECTIVE — To evaluate whether the family system variables of adults with diabetes relate to the adequacy of metabolic control or the psychosocial adaptation to the illness.

RESEARCH DESIGN AND METHODS — A total of 150 insulin-requiring adults were assessed on a single occasion. They completed two family system measures (the Family Environment Scale [FES] and the Diabetes Family Behavior Checklist [DFBC]), two quality-of-life measures (the Diabetes Quality of Life Scale and the Medical Outcomes Study Health Survey-36), and one measure of cognitive appraisal (the Appraisal of Diabetes Scale). Glycemic control was assessed using HbA_{1c} results. Demographic data (age, sex, diabetes type, duration of diabetes, and number of diabetes-related medical complications) were gathered from the patients' charts.

RESULTS — Concerning glycemic control, none of the family system measures were significant predictors of HbA_{1c}. Older age and longer duration of diabetes predicted higher HbA_{1c} values. For psychosocial adaptation, when family members behaved in ways that supported the diabetes care regimen (measured by the DFBC), the individual with diabetes was more satisfied with his or her adaptation to the illness and reported less interference in role function due to emotional problems. Family cohesion (measured by the FES) also related to better physical function. Women reported higher levels of diabetes satisfaction. The Appraisal of Diabetes Scale predicted glycemic control and psychosocial adaptation.

CONCLUSIONS — For insulin-treated adults with diabetes, family system variables do not relate to glycemic control, but they do relate to psychosocial adaptation. Future work should explore the impact of family-centered interventions on adaptation, sex differences in adaptation, and the use of the Appraisal of Diabetes Scale as a first-line clinical screening tool.

There is a growing recognition in medicine of the importance of the patients' social context in enabling them to manage their chronic illnesses effectively (1). In diabetes research, studies have focused on the effects of the family milieu of a child with diabetes on his or her adherence to the insulin, diet, and activity regimen, to glycemic control, and to emotional adaptation. Conflicting results have emerged. Several cross-sectional studies report that poor glycemic control is associated with poor family functioning (i.e., high conflict and/or low cohesion) (2–4). Two longitudinal studies have confirmed this finding (5,6), while one (7) found no such relationship. Hanson et al. (8), working with adolescents, demonstrated the complexity of the relationship between family function and glycemic control. When simple correlations were examined, good glycemic control was associated with high family cohesion, flexibility, and high marital satisfaction. However, when the duration of disease was controlled, these relationships decreased significantly and only held for patients with a short disease duration.

There are only a few studies that have investigated the relationship of family environment to outcome for adults with diabetes. Using the Family APGAR, measuring the patient's level of satisfaction with five components of family function (adaptation, partnership, growth, affection, and resolve), Cardenas et al. (9) examined the percentage of subjects from "functional" families in three glycemic control groups. Data showed significant differences among the groups. However, design problems are noteworthy, including equating the level of satisfaction with the type of family environment, using unsophisticated statistical techniques, lack of control for disease duration or treatment, and using less-sensitive fasting plasma glucose levels. Eaton et al. (10) used the Family Adaptability and Cohesion Evaluation Scale. However, they eliminated the adaptability scores due to poor convergent validity, and they did not control for age or duration of disease, both of which did correlate with glycemic control. The cohesiveness score did negatively correlate with HbA_{1c} levels. Lastly, Konen et al. (11) found conflicting results with non-insulin-dependent versus insulin-dependent adults and that the differences were confounded by race and age.

Schafer et al. (12) argued that measures that assessed family behaviors specific to the diabetes self-care regimen would more likely relate to adherence and control. They developed the Diabetes Family Behavior Checklist (DFBC) to assess family behaviors believed to be both supportive (e.g., "congratulate you for sticking to your diabetes schedule") and nonsupportive (e.g., "argue with you about your self-care") of self-care. In an adult sample (n = 54), they found that negative DFBC scores predicted self-reported adherence to regimen at a 6-month follow-up, but positive DFBC scores did not. Also, negative scores were marginally associated with poorer metabolic control.

It is clear that the influence of family environment and behaviors on adults with

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Abbreviations: ADS, Appraisal of Diabetes Scale; DCCT, Diabetes Control and Complications Trial; DFBC, Diabetes Family Behavior Checklist; DQOL, Diabetes Quality of Life; FES, Family Environment Scale; SF-36, Medical Outcomes Study Health Survey; WBQ, Well-Being Questionnaire.

diabetes warrants further investigation. For the present study, we posed two questions: For adults with diabetes, do family system variables relate to the adequacy of metabolic control and/or to the adequacy of an individual's psychosocial adaptation to the illness?

RESEARCH DESIGN AND METHODS

Subjects
One hundred and fifty subjects were recruited from adults with diabetes being treated at two sites, the Joslin Center for Diabetes at SUNY Health Science Center in Syracuse ($n = 133$) and the Diabetes Clinic at the Syracuse Veteran's Administration Medical Center ($n = 17$). Subjects were included if they were >18 years of age, had been diagnosed with diabetes for >1 year, had no current psychiatric disorder, and were able to read the forms and provide written informed consent. Only subjects currently on an insulin regimen were included in order to minimize potential effect of type of treatment. A research assistant enlisted participation. The subjects completed questionnaires after their visit or at home and returned them by mail. This study was approved by the institutional review boards of the SUNY Health Science Center and the VA Medical Center at Syracuse, NY.

Metabolic control was determined by measuring glycated hemoglobin levels (HbA_{1c}), using the Abbott IMX glycated hemoglobin assay. HbA_{1c} values reflect the average blood glucose over the preceding 3 months and is widely accepted as a reliable and valid index of metabolic control (14). This test was completed as a routine part of their clinic visit. Staff collecting the data were blind to other research data. Both sites use the Abbott assay and are staffed by the same physicians.

Family System Measures
Family Environment Scale (FES). The 90-item FES, developed by Moos and Moos (15) measures 10 dimensions of family interaction. The 18 items of the cohesion and conflict subscales were examined. The FES has been found to have acceptable test-retest reliabilities (0.68–0.86), with numerous studies supporting its construct and discriminant validity in various populations (16). Research on medical patients (e.g., with breast cancer [17], renal disease [18], and lower back pain [19]) has shown that family environments characterized by high cohesion and low conflict are associated with better psychosocial adaptation. Subjects indicate that statements are true or false about their families, such as "Family members really help and support one another" and "We fight a lot in our family."
Diabetes Family Behavior Checklist (DFBC). The 16-item DFBC, developed by Schafer et al. (12), measures supportive and nonsupportive family behaviors specific to diabetes. Subjects rate how often a particular family member will, for example, "praise you for following your diet" and "criticize you for not exercising regularly." They report test-retest values of 0.95 and 0.77, 2-month stability from 0.84 to 0.69, and evidence of convergent validity, in that both positive and negative scores were related to the questionnaire scores of family members. Higher negative scores were associated with poorer adherence but not with glycemic control.

Psychosocial adaptation measures
Diabetes Quality of Life (DQOL) scale. The 46-item DQOL, developed by Jacobson et al. (20), assesses four aspects of quality of life specific to diabetes: diabetes satisfaction, impact and worry, and social worry, and the two worry subscales were combined to yield an overall worry score. For example, subjects rate how satisfied they are "with the amount of time it takes to manage your diabetes" and how often they worry "about whether you will miss work." Cronbach alphas reported for the scales range from 0.67 to 0.92, with 1-week test-retest reliabilities of 0.80 to 0.90 and good convergent validity demonstrated with evidence of significant correlation of the DQOL with other quality-of-life measures (21).
Medical Outcomes Study Health Survey (SF-36). The 36-item SF-36 (22) assesses six domains of functional health status: physical functioning, role functioning–physical, bodily pain, general health, vitality, social functioning, and role functioning–emotional. It has been studied with chronic illness populations (e.g., arthritis, heart disease, diabetes) (23,24). Internal consistency reliabilities range from 0.81 to 0.88, and good correlations with other general quality-of-life measures support its validity (25).
Well-Being Questionnaire (WBQ). Subjects completed the 12 items of the anxiety and depression subscales of the WBQ, a measure of affect, developed by Bradley et al. (26), that omits somatic items that might be attributable to the disease. Satisfactory scale internal consistencies (0.67–0.74) are noted. Studies of individuals with diabetes have provided evidence for construct validity by demonstrating predicted relationships with other relevant variables (i.e., number of complications, glycemic control, and being overweight) (27). Subjects rate how frequently, for example, they "feel that I am useful and needed" and have felt "nervous and anxious."
Appraisal of Diabetes Scale (ADS). The seven-item ADS, developed by Carey et al. (28), measures the individual's appraisal of the illness in terms of his or her thoughts about diabetes. For example, subjects rate, "How effective are you in coping with your diabetes?" and "How much control over your diabetes do you have?" Acceptable internal consistency (Cronbach's alpha = 0.73) and 1-week test-retest reliability ($r = 0.85$, $P < 0.001$) are reported. Strong relationships between the ADS and measures of anxiety, anger, and diabetes-related hassles and a modest relationship with adherence and control support its validity.

Demographic information
The patients' medical charts provided information on age, sex, type of diabetes, duration of diabetes, and number of diabetes-related medical complications (eye problems/retinopathy, kidney disease, foot infections, amputations, heart problems, stroke, and numbness/neuropathy).

Statistical analysis
Data analysis was completed in stages. Descriptive statistics provided information on all variables. The development of models to explore the interrelationships of the variables employed forward stepwise regression techniques. Variables were entered into the model if they met a 0.1500 significance level. F values were computed for differences among the groups. Data was analyzed using SAS version 6.04 for Windows. All analyses were established a priori at $P < 0.05$ for acceptance. Multiple comparisons corrections were used.

RESULTS — There were 84 men (56%) and 66 women (44%) participating in the study. Ages ranged from 20 to 79 years with a mean age of 51.3 ± 15.5 years (Table 1). The vast majority of subjects were white (96.7%) and married (62.4%). The average duration of diabetes was 15.6 ± 11.1 years, with 81 (54.4%) type 1 and 68 (45.6%) type 2 diabetic subjects. In terms of glycemic control, 44% were good, 25.5% were acceptable, and 30.5% were poor. Good glycemic control was defined as

Table 1—*Social and demographic characteristics of subjects*

n	150
Age (years)	51.3 ± 15.5
Sex	
Male	84 (56)
Female	66 (44)
Marital status	
Married	93 (62.4)
Divorced	19 (12.8)
Single	31 (20.8)
Widowed	6 (4.0)
Education (years)	13.6 ± 2.8
Diabetes type	
Type 1	81 (54.4)
Type 2	68 (45.6)
Diabetes complications	1.96 ± 1.53
Glycemic control (HbA_{1c})	
Good (≤7.4)	62 (44.0)
Acceptable (7.5–8.4)	36 (25.5)
Poor (>8.4)	43 (30.5)

Data are n (%).

≤7.4% (normal, ≤6.4%), based on the levels achieved in the Diabetes Control and Complications Trial (DCCT) (13). Acceptable control was defined as an HbA_{1c} value of 7.5–8.4%, based on the DCCT findings demonstrating that the risk of significant microvascular complications dramatically increases when levels are >8.4%. Poor control was defined as HbA_{1c} levels >8.4%. Recognizing the stringency of these criteria (i.e., 56% needed improved control) highlights the fact that intensive psychosocial intervention was necessary to achieve good control in the DCCT.

Glycemic control

The first analyses examined the power of the relevant variables to predict glycemic control, as measured by values of the dependent variable, HbA_{1c}, treated as a continuous variable (Table 2). Of the demographic variables, only age and duration of diabetes were found to be significant predictors of HbA_{1c} values and were entered into subsequent analyses as covariates. Since we did not find a relationship between anxiety or depression and glycemic control, WBQ scores were dropped from further analyses.

Controlling for age and duration of diabetes, the FES cohesion and FES conflict scores did not predict HbA_{1c} values. Neither the DFBC negative nor the DFBC positive scores were significant predictors of HbA_{1c}. The ADS was a strong predictor of HbA_{1c} (F = 10.31, $P \leq 0.001$).

We also examined whether glycemic control was associated with measures of adaptation and found significant relationships between the DQOL and HbA_{1c} (satisfaction: F = 9.84, $P \leq 0.002$; impact: F = 5.38, $P \leq 0.022$; worry: F = 6.17, $P \leq 0.014$), but no significant relationships between HbA_{1c} and any of the SF-36 subscales.

Psychosocial adaptation

The second series of stepwise multiple regression analyses examined the power of relevant variables to predict an individual's psychosocial adaptation to diabetes, as measured by subscales of the DQOL and the SF-36. A recent study (18) notes that despite some overlap, the DQOL and the SF-36 examine quality of life from complementary perspectives and the authors recommend using them in combination.

Examining the DQOL, age was a strong predictor of diabetes worry (F = 30.46, $P \leq 0.0001$), with a trend noted for the number of complications (F = 2.86, $P \leq 0.09$). The number of complications was a significant predictor of diabetes impact (F = 16.94, $P \leq 0.0001$), as was the duration of diabetes (F = 7.13, $P \leq 0.009$). Sex (F = 9.42, $P \leq 0.003$), duration of diabetes (F = 3.83, $P \leq 0.052$), and the number of complications (F = 6.50, $P \leq 0.012$) were significant predictors of DQOL satisfaction scores. Therefore, the variables age, sex, duration of diabetes, and the number of complications were entered into subsequent analyses. When these variables were controlled, both positive and negative DFBC scores were significant predictors of diabetes satisfaction (positive: F = 20.54, $P \leq 0.0001$; negative: F = 4.04, $P \leq 0.046$) (Table 3). There was a trend for the DFBC to predict diabetes impact (positive: F = 3.55, $P \leq 0.06$; negative: F = 3.61, $P \leq 0.06$). Diabetes worry scores were not related to family system variables. The FES conflict and cohesion scores did not predict scores on any DQOL subscale. Scores on the ADS predicted scores on all three DQOL subscales ($P < 0.0001$).

Table 2—*Stepwise regression analyses examining the effect of family environment and individual appraisal on glycemic control (HbA_{1c})*

Independent variable	Model R^2	F	Probability >F
DFBC positive	0.0527	2.38	0.1258
DFBC negative	δ	δ	δ
FES cohesion	0.0216	2.74	0.1006
FES conflict	δ	δ	δ
ADS	0.0715	10.31	0.0017*

*Significant at $P < 0.05$. δ, not significant at the 0.1500 level to permit entry into the model. Model R^2 occurs when the relevant independent variable (e.g., DFBC positive) is added to the model, which includes age and duration of diabetes. F test and significance level are indicated for the change in variance when the independent variable is added to the model.

Examining the SF-36, age, duration of diabetes, sex, and the number of complications each played some role in predicting various subscale scores. For example, both age and duration of diabetes predicted subscale scores measuring physical function, role functioning–physical and –emotional, and bodily pain. Therefore, these variables were included in all subsequent analyses. Diabetes type (1 vs. 2) was not a significant predictor variable. Controlling for these factors (Table 4), DFBC positive scores predicted bodily pain (F = 20.73, $P \leq 0.0001$) and role functioning–emotional (F = 4.25, $P \leq 0.041$). DFBC negative scores predicted overall mental health (F = 5.90, $P \leq$

Table 3—*Stepwise regression analyses examining the effect of family environment and individual appraisal on psychosocial adaptation (DQOL)*

Independent	Diabetes satisfaction		Diabetes impact		Diabetes worry	
variable	Model R^2	F	Model R^2	F	Model R^2	F
DFBC positive	0.1472	20.55†	0.2002	3.55	0.2281	2.40
DFBC negative	0.0778	4.04*	0.1852	3.61	δ	—
FES cohesion	δ	—	δ	—	δ	—
FES conflict	δ	—	0.1720	2.92	δ	—
ADS	0.3462	70.43†	0.4713	115.01†	0.3893	41.90†

δ, not significant at the 0.1500 level to permit entry into the model. *$P < 0.05$; †$P < 0.001$. Model R^2 occurs when the relevant independent variable (e.g., DFBC positive) is added to the model, which includes age, duration of diabetes, sex, and number of complications. F test and significance level are indicated for the change in variance when the index variable is added to the model.

Table 4—*Stepwise regression analyses examining the effect of family environment and individual appraisal on psychosocial adaptation (SF-36)*

Independent variable	Physical function		Social function		Role-physical		Role-emotional		Bodily pain		Vitality		Mental health	
	Model R^2	F	Model R^2	F	Model R^2	F	Model R^2	F	Model R^2	F	Model R^2	F	Model R^2	F
DFBC positive	δ	—	δ	—	δ	—	0.1174	4.71*	0.3645	20.73†	δ	—	δ	—
DFBC negative	δ	—	δ	—	δ	—	δ	—	δ	—	δ	—	0.0454	5.89*
FES cohesion	0.4417	5.95*	δ	—	0.3130	3.22	0.1328	7.65*	0.3272	11.61*	0.0817	3.02	δ	—
FES conflict	δ	—	δ	—	δ	—	δ	—	δ	—	δ	—	δ	—
ADS	0.4611	2.78	δ	—	0.3392	11.51*	0.1745	29.59†	0.3047	12.79*	δ	—	δ	—

δ, not significant at the 0.1500 level to permit entry into the model. *$P < 0.05$; †$P < 0.001$. Model R^2 occurs when the relevant independent variable (e.g., DFBC positive) is added to the model, which includes age, duration of diabetes, sex, and number of complications. F test and significance level are indicated for the change in variance when the index variable is added to the model.

0.017). FES cohesion scores predicted physical function ($F = 5.95$, $P \leq 0.016$), bodily pain ($F = 11.61$, $P \leq 0.0009$), and role function–emotional ($F = 7.65$, $P \leq 0.006$), with a trend noted for role function–physical ($F = 3.22$, $P \leq 0.075$). The ADS predicted role function–physical ($P \leq 0.0009$) and –emotional ($P \leq 0.0072$) and bodily pain ($P \leq 0.0005$).

CONCLUSIONS — Our first question was whether glycemic control is related to family system variables in adults with diabetes. No direct relationship was demonstrated from our data. Whether we assessed family behaviors that support or sabotage the diabetes regimen or family cohesion and conflict, the results were the same. It is possible that no relationship was found because of sampling biases. We do not have data on individuals who refused to participate or about the actual family structure of subjects, which raises the possibility that the sample was not representative. Also, some other dimension of family functioning may be related to control. However, earlier research that found a relationship did not control for age, disease duration, or diabetes type, which weakens their conclusions in light of this study and others that show that older age and longer disease duration do predict control (9–11). The study highlights the importance of controlling for these variables in psychosocial research.

Our second question was whether psychosocial adaptation is related to family system variables in adults with diabetes. The data indicate that when family members behave in ways that support the diabetes regimen, the individual with diabetes is more satisfied with varied aspects of their own adaptation to the illness (e.g., treatment, appearance, activities) and when family members are not supportive the individual with diabetes is less satisfied. A trend for positive and negative diabetes-specific family behaviors to affect impact is also noteworthy. Similarly, more positive family behaviors and higher family cohesion predicted less effect of pain and better "emotional role function" (i.e., the extent to which an individual's emotional problems [e.g., depression, anxiety] interfere with regular activities), while nonsupportive family behaviors predicted poorer overall mental health. Finally, individuals who perceived their families as more cohesive reported higher levels of physical function.

Given the numerous factors that affect glycemic control (e.g., degree of insulin deficiency, insulin resistance, diet), the effect of any one psychosocial variable, such as family support, may be difficult to assess or may play too minor a role. The finding that control relates to diabetes-specific, but not general, adaptation highlights the importance of assessing these domains in quality-of-life research. However, if we look at successful adaptation, psychosocial factors are more relevant. Emotional adjustment to diabetes, level of function, and illness impact are important specific quality-of-life outcomes that appear to relate to control. Counseling family members to support the individual with diabetes may ease emotional distress and improve functioning, certainly significant outcomes, and may also contribute to better control.

Demographic data show that older individuals report poorer physical and role function and greater impact of pain, and those who had diabetes longer reported more disease impact. Sex also emerged in some analyses, with women reporting a higher level of satisfaction with various diabetes-related aspects of their lives (e.g., treatment, diet, body appearance, life activities, more vitality). To our knowledge, this is the first study to identify sex differences in aspects of psychosocial adaptation. There have been several studies exploring eating disorders (29) and problems with sexuality (30) in women with diabetes. Jacobson et al. (31) reported that sex did not correlate with adolescents' regimen adherence, but sex has received little attention as a variable that might affect regimen adherence, glycemic control, or psychosocial adaptation. If differences are supported in future research, there may be implications for different interventions for men and women.

The finding that individuals with fewer complications reported more impact and more worry, despite the greater impact on overall function as complications increase, was unexpected.

However, as many patients ignore their illness before complications develop (32), those with no complications may not report much impact or worry since the disease can still be ignored. When the first complication develops is the point at which they start trying to manage the diabetes, when the disease begins to more greatly impact the individual and the worry becomes evident.

A limitation of the study is that it was cross-sectional; therefore, causality could not be determined. We cannot say that family support causes improved adaptation. It may be that individuals who are successfully adapting perceive their families as more supportive because of a more generally positive view of the world. Only longitudinal studies can address the issue of causality.

This work used the ADS, which was found to strongly predict both glycemic control and diabetes-related quality of life. What is most likely is that negative appraisal is one aspect of poor quality of life, analogous to satisfaction or worry. The significance is that the data points to the ADS as a potentially useful tool for screening, to identify individuals who may be at risk for, or currently experiencing, a poor quality of life. This brief, readily accepted, and easily scored measure has clear advantages over longer more complex tools with complicated scoring protocols. The ADS is a potential first-line screening instrument likely to be useful in a clinical setting.

In summary, our research indicates that family system variables are not directly related to glycemic control. However, when an individual with diabetes perceives his or her family as being more cohesive and supportive of the diabetic care regimen, he or she is more likely to report a better psychosocial adaptation with less emotional distress and higher levels of functioning. Both the DFBC and the FES cohesion subscale may be good tools to use clinically with individual families. Future work might focus on identifying families who would benefit from family-centered interventions and measuring whether the intervention served to enhance family support and positively impact adaptation. Special attention might be paid to the elderly and those who have had diabetes for many years, where one would expect that the developmental tasks of the family would differ when compared with those of the family with a young adult with diabetes. Additionally, sex-related differences and the usefulness of the ADS as a screening tool are other important directions for future research.

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