

Glycemic Control in Youth with Type 1 Diabetes: Family Predictors and Mediators

Danny C. Duke,^{1,2} MS, Gary R. Geffken,^{1,2,3} PhD, Adam B. Lewin,⁴ PhD, Laura B. Williams,⁵ PhD, Eric A. Storch,^{2,3} PhD, and Janet H. Silverstein,³ MD

¹Department of Clinical and Health Psychology, ²Department of Psychiatry, ³Department of Pediatrics, University of Florida, ⁴Semel Neuropsychiatric Institute, University of California, and ⁵Behavioral Medicine & Clinical Psychology, Cincinnati Children's Hospital Medical Center

Objective This study examined predictive and mediated relationships among youth perception of critical parenting, Child Behavior Checklist Externalizing Subscale (CBCL) externalizing problem scores, adherence, and (hemoglobin A_{1c} HbA_{1c}), in youth with type 1 diabetes from low socioeconomic status families. **Methods** Caregiver/youth dyads ($n = 120$) completed diabetes specific measures of family functioning regarding diabetes management and structured adherence interviews. Parents completed the CBCL, while assays of youth HbA_{1c} were performed. Analyses were conducted using hierarchical linear regression. **Results** Combined measures predicted 44% of the variance in HbA_{1c}. Adherence partially mediated critical parenting and HbA_{1c}, while critical parenting and adherence mediated CBCL externalizing problem scores and HbA_{1c}. CBCL externalizing problem scores did not mediate critical parenting and HbA_{1c}. **Conclusions** The presence of youth perceptions of critical parenting and youth externalizing behavior problems may interfere with adherence, leading to increases in HbA_{1c}.

Key words adherence; chronic illness; endocrinology; externalizing; family functioning; glycemic control; HbA_{1c}; parents; type 1 diabetes.

Type 1 diabetes (T1D) is one of the most common chronic diseases of school-aged youth, affecting approximately 1 in every 400–600 youth under 20 years of age (National Institute of Diabetes and Digestive and Kidney Diseases, 2005). Intensive treatment regimens have resulted in improved glycemic control (hemoglobin A_{1c} [HbA_{1c}]) and decreased long-term health risk (Diabetes Control and Complications Trial Research Group [DCCT], 1993; DCCT/Epidemiology of Diabetes Interventions and Complications study Research group [EDIC], 2005) for youth. Following a diagnosis of T1D, the patient is expected to integrate intensive regimens into their daily routine. It is not surprising that with the use of more complex routines, youth nonadherence remains a prevalent problem (Ellis, Naar-King, Frey, Rowland, & Greger, 2003; Kovacs, Goldston, Obrosky, & Iyengar, 1992; Weissberg-Benchell et al., 1995) that may result in serious health consequences (DCCT, 1993, 1994; DCCT/EDIC, 2005).

One explanation for youth nonadherence to T1D treatment regimens may be found in Patterson's (1982) coercion model. This model proposes a process of behavioral contingencies that explain how parent and youth behaviors influence each other in ways that increase the likelihood that youth aggressive behavior will increase while parental control over such behaviors will decrease (Patterson, 1995; Patterson, Reid, & Dishion, 1992; Reid, Patterson, & Snyder, 2002). These interchanges are typically characterized by parental demands for compliance, the child's refusal to comply, his or her escalating complaints, and finally the parent's capitulation. If such a coercive cycle becomes associated with the demands of diabetes management, it is likely to interfere with the youth's adherence to their treatment regimen, resulting in worsened glycemic control. Therefore, we expected that measures of family functioning would be related to adherence and HbA_{1c}.

All correspondence concerning this article should be addressed to Gary R. Geffken, PhD, Department of Clinical and Health Psychology, University of Florida, PO Box 100165, 101 S. Newell Drive No. 3151, FL, USA.
E-mail: geffken@ufl.edu

Journal of Pediatric Psychology 33(7) pp. 719–727, 2008

doi:10.1093/jpepsy/jsn012

Advance Access publication February 23, 2008

Journal of Pediatric Psychology vol. 33 no. 7 © The Author 2008. Published by Oxford University Press on behalf of the Society of Pediatric Psychology. All rights reserved. For permissions, please e-mail: journals.permissions@oxfordjournals.org

Given an established relationship between adherence and HbA_{1c} (Anderson, 2004), it is likely that the effects of disrupted family functioning on HbA_{1c} are caused by decreased adherence, i.e., adherence should mediate the relationship between measures of family functioning and HbA_{1c}. Such a relationship between family functioning, adherence, and HbA_{1c} has been documented in previous research. In a study conducted by Lewin et al. (2006), critical parenting was found to be the strongest predictor, among several predictors comprising a family variable composite, accounting for the largest portion of variance in glycemic control ($\beta = .38$ $p < .001$). Given the relative strength of critical parenting in the Lewin et al. (2006) model, we expected that critical parenting would emerge as the strongest predictor of HbA_{1c} in the current study. Further, we expected that adherence would mediate the relationship between critical parenting and HbA_{1c}.

We expected that critical parent behavior would be only one contributor to a reciprocal cycle of parent–youth interaction. Such a cycle would necessarily include contributions from youth. Also, it is likely that the presence of negative youth behaviors would contribute to the erosion of adherence processes. In support of this conceptualization, recent work found that the presence of youth externalizing problems was related to glycemic control. For example, Northam, Matthews, Anderson, Cameron, and Werther (2005) found that in a sample of adolescents with T1D, those with high blood sugars had increased levels of externalizing problems compared to those with low blood sugars. Additionally, Leonard, Yuh-Pyng, Savik, Plumbo, and Christensen (2002) found that participants with elevated attention problems, and aggressive and delinquent behaviors, reported higher HbA_{1c} relative to those without such problems. We posited that youth externalizing problems [Child Behavior Checklist Externalizing Subscale (CBCL) externalizing problem scores] would contribute to patterns of conflict with caregivers, subsequently interfering with adherence processes, thereby decreasing glycemic control (increased HbA_{1c}). Therefore, an aim of the current study was to examine whether adherence mediated the relationship between externalizing problems and glycemic control. Elucidating the direction of effects between critical parenting and youth externalizing problems was an additional aim. We examined critical parenting as a mediator between externalizing problems and HbA_{1c}, and we examined externalizing problems as mediating the relationship between critical parenting and HbA_{1c} to provide evidence of the predominate direction of effects between caregiver and youth.

Research Aims

Our *first aim* was to examine whether diabetes-specific measures of family functioning accounted for significant variance in HbA_{1c}. Our *second aim* was to examine whether the relationship between critical parenting and HbA_{1c} was mediated by adherence. Our *third aim* was to determine whether the relationship between youth externalizing problems and HbA_{1c} was mediated by adherence. Our *fourth aim* was to determine if the relationship between youth externalizing problems and HbA_{1c} was mediated by critical parenting. Finally, our *fifth aim* was to determine if the relationship between critical parenting and HbA_{1c} was mediated by youth externalizing problems.

Method

Participants and Procedures

Participants were 120 youth and their caregivers, typical of the patients seen at the outpatient, university affiliated, pediatric diabetes clinic. This sample was recruited from a clinic serving a largely rural population comprised primarily of low economic status families typically sponsored by state-funded insurance (modal income = \$30K, median = \$36K). The sample was composed of 51 males and 69 females with T1D, ages 8.25–18.75 years ($M = 13.92$, $SD = 2.71$). The race/ethnic distribution was 72.5% Caucasian, 15.0% African American, 10.0% Hispanic, and 2.5% who identified as “other” race or ethnicity. All measures were completed by one caregiver who self-identified as 78.3% mothers, 13.3% fathers, and 8.4% other caregivers.

After obtaining appropriate institutional review board approval from the University of Florida, families were approached with youth who presented with a diagnosis of T1D of at least 6 months duration, living with and accompanied by their primary caretaker, and with no evidence of mental retardation. The consent rate was 82.2% (120/146). Following informed consent/assent, trained research assistants, unfamiliar with the patient, and the patient’s glycemic control, administered separate interviews of ~10–15 min in length to both caregiver and youth. Self-report questionnaires were also completed by caregiver and youth. Blood samples for analyzing HbA_{1c} were drawn by medical staff as a routine component of each patient’s visit.

Measures

Diabetes-Specific Measures of Family Functioning

Diabetes Family Behavior Scale (DFBS). The DFBS is a self-report measure of perceived family support completed by

Table I. Correlations Among Study Variables

Variable	1	2	3	4	5	6	7	8	9	10
1 HbA _{1c}	–	.227**	.267**	–.164*	–.378**	–.614**	–.113	–.081	.405**	.271**
2 Youth age		–	.127	–.185	–.172	–.364**	–.144	–.570**	.253**	.000
3 Duration of diabetes			–	–.109	–.097	–.257**	–.082	.008	.042	.123
4 Estimate of family income				–	.216*	.212*	.058	.118	–.081	–.086
5 Youth adherence (DSMP)					–	.501**	.108	.073	–.279*	–.269**
6 Parent adherence (DSMP)						–	.179*	.128	–.374**	–.358**
7 Warmth and caring (DFBS)							–	.193*	–.324**	–.320**
8 Guidance and control (DFBS)								–	–.225*	–.095
9 Critical parenting (DFBC)									–	.310**
10 Externalizing problems (CBCL)										–

* $p < .05$; ** $p < .01$.

youth with T1D (Waller et al., 1986). Given the aims of this study, only the “warmth and caring” and “guidance and control” subscales were used. The warmth/caring subscale (DFBS-WC; $\alpha = 0.79$) and guidance and control subscales (DFBS-GC; $\alpha = 0.76$) have shown good internal consistency (Lewin et al., 2006; McKelvey et al., 1993). Cronbach’s alphas for our study were good ($\alpha = .75$) for warmth and caring, and marginal ($\alpha = .65$) for the guidance and control subscales.

Diabetes Family Behavior Checklist (DFBC). The DFBC is a measure of both supportive and unsupportive family behaviors related to the diabetes regimen, completed by both parents and youth (Schafer, McCaul, & Glasgow, 1986). Given the aims of this study only the 7-item, youth reported, negative/unsupportive subscale was used; herein referred to as “critical parenting.” The scale has shown acceptable to good internal consistency (.74 to .82; Schafer, personal communication, 1998). Cronbach’s alpha for our study was marginal ($\alpha = .64$).

Youth Externalizing Problems

Child Behavior Checklist Externalizing Subscale (CBCL). The CBCL is a widely used, standardized, 118-item parent-report questionnaire for 4–18-years-old that assesses behavioral problems and social competencies of youth 4–18 years of age (Achenbach, 1991). The CBCL yields a broadband, higher order externalizing scale (Achenbach, 1991; Cohen, Gotlieb, Kershner, & Wehrspann, 1985; Drotar, Stein, & Perrin, 1995). Cronbach’s alpha for our study was excellent ($\alpha = .94$).

Measurement of Adherence

Diabetes Self-management Profile (DSMP). The DSMP is a structured interview, consisting of 23 questions having an administration time of ~15 to 20 min. Questions assess five areas of diabetes management, including: insulin administration/dose adjustment, blood-glucose monitoring, exercise, diet, and management of hypoglycemia. The scale has

shown good internal consistency ($\alpha = .76$) and inter-observer agreement (94%; Harris et al., 2000). Cronbach’s alphas in our study were good for interviews with caregivers ($\alpha = .86$) and marginal for those with youth ($\alpha = .65$).

Measure of Glycemic Control

Glycemic Control (HbA_{1c}). Glycemic control was determined by a glycosylated HbA_{1c} assay that provided an estimate of blood glucose levels over the preceding 2–3 months (American Diabetes Association, 2003). Patients routinely have their blood drawn and assayed as part of their regularly scheduled appointments. Blood samples were analyzed using a Bayer DCA 2000+.

Results

Preliminary Analyses

Relationships among variables were examined for purposes of control in regression analyses. HbA_{1c} was significantly correlated with youth’s age, duration of diabetes, and family income. Youth age was significantly correlated to the critical parenting (DFBC), guidance and control (DFBS-GC), and parent reported adherence (DSMP). Family income was significantly correlated to both youth and parent reported adherence (DSMP). Duration of diabetes was significantly related to parent reported adherence (DSMP). Correlations among variables are shown in Table I. Given the above described relationships, youth age, duration of diabetes, and income were controlled in subsequent regression analyses. All remaining demographic variables were not significantly related to study measures.

As a means of screening for possible interaction effects, gender differences were examined across study variables. No gender differences were found for outcome or predictor variables. Analysis of mean CBCL externalizing problem scores suggested that overall scores were not

Table II. HbA_{1c} Predicted by Diabetes-related Family Factors and Adherence

Step	Variables	R ²	ΔR ²	F	β
1		.068	.068	3.75*	
	Youth age				.038
	Income				-.015
2		.121	.051	5.95*	
	Duration of diabetes				.124
3		.237	.118	5.09**	
	Warmth and caring (DFBS)				.072
	Guidance and control (DFBS)				.031
	Critical parenting (DFBC)				.208*
4		.439	.195	16.67**	
	Youth reported adherence (DSMP)				-.063
	Parent reported adherence (DSMP)				-.476**

All standardized regression coefficients are from the final block of the equation.
* $p < .05$; ** $p < .01$.

elevated in this sample ($M = 8.50$, $SD = 8.37$). Correlations among variables are shown in Table I. All regression analyses were assessed for collinearity by calculating tolerance and variance inflation factors (VIF). No significant collinearity was identified (Bowerman & O'Connell, 1990).

Mediation Analyses

The presence of mediation effects were tested using hierarchical linear regression according to guidelines recommended by Baron and Kenny (1986) as follows: (a) the predictor should be significantly associated with the outcome, (b) the predictor should be significantly associated with the mediator, (c) the mediator should be associated with the outcome variable, and lastly (d) the addition of the mediator to the full model should significantly reduce the relationship between the predictor and outcome variable. Standardized coefficients were calculated to examine changes in path coefficients with the addition of the mediator to the model. Sobel's Z-Scores (Sobel, 1988) were calculated to assess the significance of changes in the path coefficients.

Study Aim 1: Regression of HbA_{1c} on Family Functioning and Adherence

After controlling for demographic variables, youth report of critical parenting significantly predicted HbA_{1c} ($\beta = .208$, $p < .01$) (Table II). In the same analyses, parent report of adherence accounted for significant variance ($\beta = -.476$, $p < .01$). Demographic variables accounted for 12.1% of the variance, while the complete model accounted for ~43.9% of the variance in HbA_{1c}. Follow-up analyses

revealed that youth report of adherence failed to add significantly beyond the contributions of parent report alone. Additionally, warmth and caring, guidance and control, and lack of responsibility, failed to add significantly to the model. Therefore, these variables were not included in subsequent analyses.

Study Aim 2: Adherence Mediating Critical Parenting (DFBC) and HbA_{1c}

Critical parenting was associated significantly with HbA_{1c} and adherence. Adherence was associated with HbA_{1c} and the effect for critical parenting on HbA_{1c} was significantly ($z = -6.70$, $p < .001$) reduced when adherence was included in the analysis (Fig. 1a). Because the path coefficient between family factors and glycemic control remained significant while controlling for adherence, partial mediation was indicated. Standardized coefficients equaled .204 for direct and .201 for indirect effects. In this model, parent report of adherence accounted for ~27.4% of the variance in HbA_{1c} while critical parenting (DSMP) accounted for 3.5% of the variance in HbA_{1c} (Table III).

Study Aim 3: Adherence (DSMP) Mediating Externalizing Problem Scores (CBCL) and HbA_{1c}

Youth externalizing problems were associated significantly with HbA_{1c} and adherence. Adherence was associated with HbA_{1c} and the effect for youth externalizing problems on HbA_{1c} was significantly ($z = 3.66$, $p < .001$) reduced when adherence was included in the equation (Fig. 1b). In the final model, youth externalizing problems did not account for a significant portion of the variance in glycemic control, indicating full mediation (Table IV). Full mediation was further indicated as the path coefficient between externalizing problem scores and glycemic control was reduced to nonsignificance while controlling for adherence (Fig. 1b). Standardized coefficients equaled .059 for direct and .212 for indirect effects.

Study Aim 4: Critical Parenting (DFBC) Mediating CBCL Problem Scores and HbA_{1c}

Youth externalizing problems were associated significantly with HbA_{1c} and critical parenting. Critical parenting was associated with HbA_{1c} and the effect for youth externalizing problems on HbA_{1c} was significantly ($z = 2.67$, $p < .001$) reduced when adherence was included in the equation (Fig. 1c). In the final model (Table V), CBCL externalizing problems did not account for a significant portion of the variance in HbA_{1c}, indicating full mediation. Further, full mediation was also indicated as the path coefficient between the CBCL externalizing problem scores

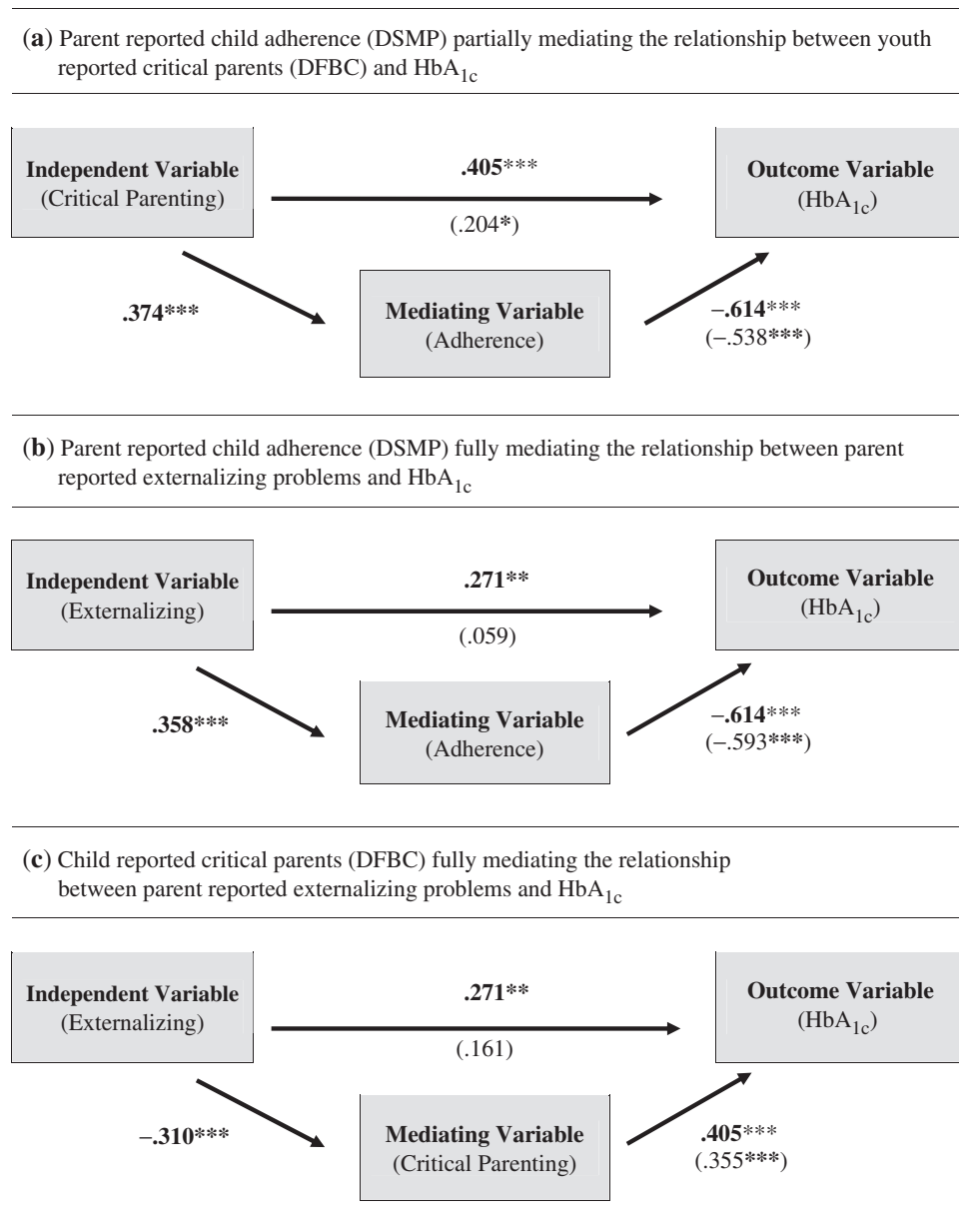


Figure 1. Mediation models.

and glycemic control was reduced to nonsignificance while controlling for family factors (Fig. 1c). Standardized coefficients equaled .161 for direct, and .110 for indirect effects.

Study aim 5: CBCL Externalizing Problem Scores Mediating Critical parenting (DFBC) and HbA_{1c}

Critical parenting was associated significantly with HbA_{1c} and youth externalizing problems. Youth externalizing problems were associated with HbA_{1c} and the effect for critical parenting on HbA_{1c} was not significantly ($z = .75$, $p < .45$) reduced when adherence was included in the

equation. Therefore, youth externalizing problems (CBCL) did not mediate the relationship between critical parenting and HbA_{1c}. The path coefficient between critical parenting (DFBC) and HbA_{1c} was reduced from .405 to .378 with the addition of externalizing problem scores to the model.

Post Hoc Analysis

Regression analyses as per guidelines established by Baron and Kenny (1986) to determine whether youth age moderated the relationship between critical parenting and HbA_{1c} did not find evidence of significant moderation effects.

Table III. Mediation Analysis: Adherence Mediating Family Factors (DFBC) and HbA_{1c}

Step	Variables	R ²	ΔR ²	F	β
1		.067	.067	3.69*	
	Youth Age				.030
	Income				-.025
2		.121	.053	6.10*	
	Duration of diabetes				.126
3		.371	.274	45.79**	
	Parent report of adherence (DSMP)				-.492**
4		.402	.035	6.20**	
	Critical parenting (DFBC)				.206*

All standardized regression coefficients are from the final block of the equation.
p* < .05; *p* < .01.

Table IV. Mediation Regression Analysis Predicting HbA_{1c}: Adherence Mediating Youth Externalizing Behavior Problems and Glycemic control (HbA_{1c})

Step	Variables	R ²	ΔR ²	F	β
1		.067	.067	3.69*	
	Youth age				.066
	Income				-.023
2		.121	.053	6.10*	
	Duration of diabetes				.124
3		.371	.274	45.79**	
	Parent report of adherence (DSMP)				-.492**
4		.398	.003	.55	
	Youth externalizing problems (CBCL)				.062

All standardized regression coefficients are from the final block of the equation.
p* < .05; *p* < .01.

Table V. Mediation Regression Analysis Predicting HbA_{1c}: Family Factors (DFBC) Mediating Youth Externalizing Behavior Problems and HbA_{1c}

Step	Variables	R ²	ΔR ²	F	β
1		.067	.067	3.69*	
	Youth age				.103
	Income				-.085
2		.121	.053	6.10*	
	Duration of diabetes				.215*
3		.245	.125	16.72**	
	Critical parenting (DFBC)				.320**
4		.262	.017	2.28	
	Youth externalizing problems (CBCL)				.138

All standardized regression coefficients are from the final block of the equation.
p* < .05; *p* < .01.

Discussion

This study identified disruptive patterns of parent–youth behaviors in an understudied sample of predominately low socioeconomic status (SES) caregivers and youth with T1D. Hypothesized a priori relationships among adherence, a measure of youth externalizing problems, measures of family functioning, and HbA_{1c} were examined.

Regression analysis indicated that a combination of diabetes specific measures of family behavior accounted for 11.8% of the variance in glycemic control after controlling for demographic variables. This finding is consistent with the general literature that has demonstrated that youth perception of family support is important to the management of T1D (Cohen, Lumley, Naar-King, Partridge, & Cakan, 2004; Hood, Butler, Anderson, & Laffel, 2007; Miller-Johnson et al., 1994; Naar-King, Podolski, Ellis, Frey, & Templin, 2006). Youth who reported more critical parenting, specific to diabetes management, had higher measures of HbA_{1c}. This finding is congruent with Patterson’s coercion model (Patterson, 1982), suggesting that youth who perceive caregivers as critical or coercive regarding diabetes tasks may resist parental attempts at control by refusing to appropriately adhere to their treatment regimen, causing increases in HbA_{1c}.

When viewed within the context of coercion theory (Patterson, 1982) our findings suggest that the presence of youth externalizing problems precipitate ineffective and unintentional caregiver responses (e.g., nagging or criticizing) that, in turn, exacerbate youth resistance to parental demands, interrupting adherence processes (Fig. 2). Although it is widely held that caregiver behaviors precede the development of behaviors in youth, our findings suggest that a negative pattern of behavior around diabetes management tasks may be precipitated by the youth. Mediation analyses suggest that, at least during late childhood through adolescence, externalizing behavior problems have their effect on diabetes outcomes through ineffective parenting practices and not the reverse. Given that child externalizing problems produce caregiver responses that are perceived as nagging and criticizing by the youth, it follows that both youth externalizing problems and parental criticizing contribute to patterns of decreased adherence to the treatment regimen, which in turn causes reductions in glycemic control. Caregiver



Figure 2. Proposed behavior pattern regarding diabetes management in youth.

inability to establish firm and consistent rules and enforce appropriate behavioral limits when dealing with externalizing problems, such as stubbornness and arguing, likely contributes to a cyclical and mutually reinforcing behavior pattern that disrupts adherence.

It is important to note limitations of this study. First, due to the cross-sectional nature of data collection, statements about causal and directional relationships can only be inferred. Future research would be improved by adopting a longitudinal approach to examining factors impacting adherence. Second, while participants were informed that no parent or physician would see their results and were encouraged to be as truthful and accurate as possible, there exists potential for reporting bias on questionnaires and during interviews. Third, as this population was a largely rural, low SES population, these findings may not generalize to other settings. Fourth, as some measures used in this study were designed for use with older diabetes management practices they may be less valid for newer and more complex strategies. Updated adherence measures, similar to those developed by the Diabetes Research in Children Network (DirecNet) Study Group (2005), should be used as they should more accurately address the complexity of modern T1D management. Finally, Perrin, Stein, and Drotar (1991) reported concerns regarding using the CBCL for children with chronic illness that should be addressed. Concerns that may be relevant for this study included a possible bias in reporting or interpretation of somatic symptoms and limited sensitivity to detecting mild adjustment problems. As this study used only the CBCL externalizing subscale that is comprised of few behaviors that may be directly attributed to chronic illness, it is less influenced by bias in reporting or interpretation of somatic symptoms than some other CBCL subscales. As suggested by Perrin et al. (1991), raw scores were used for analyses, maximizing our sensitivity to detect mild symptoms.

Within these limitations, this study found important relationships between family, youth behaviors, and adherence that were significantly related to HbA_{1c}. These findings suggest that assessment of youth perceptions of critical parenting practices, and youth externalizing problems may add information relevant to clinical assessment. Such a preventative approach may lead to timely and specifically targeted interventions, thereby reducing the risk associated with poorly controlled diabetes. Of particular importance is ameliorating ineffective parental responses to externalizing problems that may promote and maintain argumentative interaction patterns regarding diabetes management. Continued intervention research is

critical for expanding the effectiveness of psychological interventions with youth with T1D. Specifically, the recent application of behavioral family systems (Wysocki et al., 2006, 2007) and multisystemic therapy (Ellis, Podolski, Frey, Naar-King, & Moltz, 2007) shows promise for remediation of these problems.

Family functioning, adherence, and glycemic control relationships warrant ongoing research as these and similar mediation models may further inform intervention studies. Future research should target other predictors of glycemic control that are potentially mediated by adherence, such as depression or anxiety. In addition, the modeling of such mediation processes would be improved through the use of path analysis, which can more closely model real-world complexity.

Conflicts of interest: None declared.

Received April 17, 2007; revisions received January 29, 2008; accepted February 4, 2008

References

- Achenbach, T. M. (1991). *Manual for the child behavior checklist/4-18 and 1991 profile*. Burlington: University of Vermont Department of Psychiatry.
- American Diabetes Association (2003). Standards of medical care for patients with diabetes mellitus. *Diabetes Care*, 25, S33–S50.
- Anderson, B. J. (2004). Family conflict and diabetes management in youth: Clinical lessons from child development and diabetes research. *Diabetes Spectrum*, 17, 22–26.
- Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 52, 1173–1182.
- Bowerman, B. L., & O'Connell, R. T. (1990). *Linear statistical models: An applied approach* (2nd ed.). Belmont, California: Duxbury Press.
- Cohen, N. J., Gotlieb, H., Kershner, J., & Wehrspann, W. (1985). Concurrent validity of the internalizing and externalizing profile patterns of the Achenbach child behavior checklist. *Journal of Consulting and Clinical Psychology*, 53, 724–728.
- Cohen, D. M., Lumley, M. A., Naar-King, S., Partridge, T., & Cakan, N. (2004). Child behavior problems and family functioning as predictors of adherence and glycemic control in economically disadvantaged

- children with type 1 diabetes: A prospective study. *Journal of Pediatric Psychology*, 29, 171–184.
- Diabetes Control and Complications Trial Research Group (1993). The effect of intensive treatment of diabetes on the development and progression of long-term complications in insulin-dependent diabetes mellitus. *New England Journal of Medicine*, 329, 977–986.
- Diabetes Control and Complications Trial Research Group (1994). Effect of intensive diabetes treatment on the development and progression of long-term complications in adolescents with insulin-dependent diabetes mellitus: Diabetes control and complications trial. *Journal of Pediatrics*, 125, 177–188.
- Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications (DCCT/EDIC) Study Research Group (2005). Intensive diabetes treatment and cardiovascular disease in patients with type 1 diabetes. *The New England Journal of Medicine*, 353, 2643–2653.
- Diabetes Research in Children Network (DirecNet) Study Group (2005). Diabetes self management profile for flexible insulin regimens: Cross-sectional and longitudinal analysis of psychometric properties in a pediatric sample. *Diabetes Care*, 28, 2034–2035.
- Drotar, D., Stein, R. E., & Perrin, E. C. (1995). Methodological issues in using the child behavior checklist and its related instruments in clinical psychology research. *Journal of Clinical Child Psychology*, 24, 184–192.
- Ellis, D., Naar-King, S., Frey, M., Rowland, M., & Gregor, N. (2003). Case study: Feasibility of multisystemic therapy as a treatment for urban adolescents with poorly controlled type 1 diabetes. *Journal of Pediatric Psychology*, 28, 287–293.
- Ellis, D. A., Podolski, C. L., Frey, M., Naar-King, S., Wang, B., & Moltz, K. (2007). The role of parental monitoring in adolescent health outcomes: Impact on regimen adherence in youth with type 1 diabetes. *Journal of Pediatric Psychology*.
- Harris, M. A., Wysocki, T., Sadler, M., Wilkinson, K., Harvey, L. M., Buckloh, L. M., et al. (2000). Validation of a structured interview for the assessment of diabetes self-management. *Diabetes Care*, 23, 1301–1304.
- Hood, K. K., Butler, D. A., Anderson, B. J., & Laffel, L. M. (2007). Updated and revised Diabetes Family Conflict Scale. *Diabetes Care*, 30, 1764–1769.
- Kovacs, M., Goldston, D., Obrosky, S., & Iyengar, S. (1992). Prevalence and predictors of pervasive noncompliance with medical treatment among youths with insulin dependent diabetes mellitus. *Journal of the American Academy of Child and Adolescent Psychiatry*, 31, 1112–1119.
- Leonard, B. J., Yuh-Pyng, J., Savik, K., Plumbo, P. M., & Christensen, R. (2002). Psychosocial factors associated with levels of metabolic control in youth with type 1 diabetes. *Journal of Pediatric Nursing*, 17, 28–37.
- Lewin, A. B., Heidgerken, A. D., Geffken, G. R., Williams, L. B., Storch, E. A., Gelfand, K. M., et al. (2006). The relation between family factors and metabolic control: The role of diabetes adherence. *Journal of Pediatric Psychology*, 31, 174–183.
- McKelvey, J., Waller, D. A., North, A. J., Marks, J. F., Schreiner, B., Travis, L. B., et al. (1993). Reliability and validity of the Diabetes Family Behavior Scale. *The Diabetes Educator*, 19, 125–132.
- Miller-Johnson, S., Emory, R. E., Marvin, R. S., Clarke, W., Lovinger, R., & Martin, M. (1994). Parent-child relationships and the management of insulin dependent diabetes mellitus. *Journal of Consulting and Clinical Psychology*, 62, 603–610.
- Naar-King, S., Podolski, C., Ellis, D. A., Frey, M. A., & Templin, T. (2006). Social ecological model of illness management in high-risk youths with type 1 diabetes. *Journal of Consulting and Clinical Psychology*, 74, 785–789.
- National Institute of Diabetes and Digestive and Kidney Diseases (2005). *National Diabetes Statistics fact sheet: General information and national estimates on diabetes in the United States*. Bethesda, MD: U.S. Department of Health and Human Services, National Institute of Health.
- Northam, E. A., Matthews, L. K., Anderson, P. J., Cameron, F. J., & Werther, G.A. (2005). Psychiatric morbidity and health outcome in type 1 diabetes – perspectives from a prospective longitudinal study. *Diabetic Medicine*, 22, 152–157.
- Patterson, G. R. (1982). *Coercive family processes*. Eugene, OR: Castalia.
- Patterson, G. R. (1995). Coercion as a basis for early age of onset for arrest. In J. McCord (Ed.), *Coercion and punishment in long-term perspectives* (pp. 81–105). New York: Cambridge University Press.
- Patterson, G. R., Reid, J. B., & Dishion, T. (1992). *Antisocial boys*. Eugene, OR: Castalia.

- Perrin, E. C., Stein, R. E. K., & Drotar, D. (1991). Cautions in using the child behavior checklist: Observations based on research about children with a chronic illness. *Journal of Pediatric Psychology*, 16, 411–421.
- Reid, J. B., Patterson, G. R., & Snyder, J. (2002). *Antisocial behavior in children and adolescents: A developmental analysis and model for intervention*. Washington, DC: American Psychological Association.
- Schafer, L. C., McCaul, K. D., & Glasgow, R. E. (1986). Supportive and nonsupportive family behaviors: Relationships to adherence and metabolic control in persons with type 1 diabetes. *Diabetes Care*, 9, 179–185.
- Sobel, M. E. (1988). Direct and indirect effects in linear structural equation models. In J. S. Long (Ed.), *Common problems/proper solutions: Avoiding error in quantitative research* (pp. 46–64). Beverly Hills CA: Sage.
- Waller, D. A., Chipman, J. J., Hardy, B. W., Hightower, M. S., North, A. J., Williams, S. B., et al. (1986). Measuring diabetes-specific family support and its relation to metabolic control: A preliminary report. *Journal of the American Academy of Child Psychiatry*, 25, 415–418.
- Weissberg-Benchell, J., Glasgow, A. M., Tynan, W. D., Wirtz, P., Turek, J., & Ward, J. (1995). Adolescent Diabetes Management and Mismanagement. *Diabetes Care*, 18, 77–82.
- Wysocki, T., Harris, M. A., Buckloh, L. M., Mertlich, D., Lochrie, A. S., Mauras, N., et al. (2007). Randomized trial of behavioral family systems therapy for diabetes: Maintenance of effects in diabetes outcome in adolescents. *Diabetes Care*, 30, 555–560.
- Wysocki, T., Harris, M. A., Buckloh, L. M., Mertlich, D., Lochrie, A. S., Taylor, A., et al. (2006). Effects of behavioral family systems therapy for diabetes on adolescents' family relationships, treatment adherence, and metabolic control. *Journal of Pediatric Psychology*, 31, 928–938.