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Amy E. Noser

Lindsay Huffhines

Mark A. Clements
Children's Mercy Hospital

Susana R. Patton

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Diabetes Conflict Outstrips the Positive Impact of Self-Efficacy on Youth Adherence and Glycemic Control in Type 1 Diabetes

Amy E. Noser, M.S.[1], **Lindsay Huffhines, M.S.**[1], **Mark A. Clements, M.D., Ph.D.**[2], and **Susana R. Patton, Ph.D., CDE**[3]

[1]Clinical Child Psychology Program, University of Kansas, Lawrence, KS 66045

[2]Division of Endocrinology & Diabetes, Department of Pediatrics, Children's Mercy Kansas City, Kansas City, Missouri 64108

[3]Department of Pediatrics, University of Kansas Medical Center, Kansas City, Kansas 66103

Abstract

Objective: To examine whether self-efficacy buffers the deleterious consequences of diabetes-specific family conflict on self-monitoring blood glucose (SMBG) and HbA1c in youth with type 1 diabetes mellitus (T1DM).

Methods: A total of 129 youth with T1DM (aged 10–16 years) completed measures of diabetes-specific family conflict and self-efficacy for diabetes management, and their blood glucose meter data and HbA1c were extracted from the electronic medical record. We preformed moderation analyses to examine whether self-efficacy moderated the association that diabetes-specific family conflict had with SMBG and HbA1c. We used simple slopes analyses to probe significant interactions.

Results: Our results indicated that self-efficacy moderated the association that diabetes-specific family conflict had with SMBG and HbA1c. The pattern of these findings showed that high self-efficacy buffered the negative impact of diabetes conflict on HbA1c. However, benefits of high self-efficacy for more frequent SMBG was only apparent in the context of low diabetes-specific family conflict.

Conclusions: Study findings highlight the interactive relationship between diabetes-specific family conflict and self-efficacy in relation to SMBG and glycemic control. These findings suggest that family functioning and youth's self-efficacy are promising intervention targets for families having trouble with SMBG and HbA1c.

Keywords

type 1 diabetes mellitus; family; self-management; adolescents; Hemoglobin A1c

Family conflict around diabetes-related tasks accounts for over one-third of the variance in glycemic control (1) and is increasingly recognized as a major factor in diabetes

Correspondence concerning this article should be addressed to Susana R. Patton, Ph.D., CDE, University of Kansas Medical Center, MS 4004, 3901 Rainbow Blvd, Kansas City, KS 66160. spatton2@kumc.edu; Phone: 913-588-6323; Fax: 913-588-2253.

management (2–6). Conflict around diabetes care likely interferes with parents' ability to monitor, collaborate with, and be involved in their youth's diabetes management, or creates a hostile environment where youth might avoid diabetes care tasks to avoid conflict. Families may also be less able to communicate effectively or solve adherence problems together, which can have a detrimental effect on their ability to execute tasks of diabetes care accurately (7). Prior research demonstrated that diabetes-specific family conflict at baseline predicted less frequent blood glucose monitoring at 6 months, which in turn predicted higher glycated hemoglobin levels (HbA1c) levels at 12 months (8), supporting the notion of adherence as a mediator. Family conflict, however, is not the only factor influencing adherence and subsequent glycemic control; several studies also show this effect for youth with low self-efficacy (4; 9). However, self-efficacy is considered a protective factor within the *Childhood Adaptation to Chronic Illness: Diabetes Mellitus* model, and may moderate the relation between family conflict and adherence to diabetes tasks (10). Specifically, the model posits that in circumstances where family conflict is abundant, self-efficacy may be essential for buffering youth from the negative effects of conflict thus allowing youth to continue with diabetes self-management. Although one study found that self-management mediated the relation between family conflict and HbA1c (11), no study has considered the possibility of self-efficacious youth managing diabetes tasks *despite* family problems. Thus, this study expands on the existing literature by investigating a moderation paradigm between family conflict and self-efficacy with adherence and glycemic control. Precisely, we hypothesized that self-efficacy would moderate the relation between family conflict and 1) self-monitoring of blood glucose (SMBG) and 2) HbA1c, or more specifically, that youth high in self-efficacy and living in high-family conflict homes would demonstrate greater SMBG and lower HbA1c levels than youth low with self-efficacy and living in high-family conflict homes.

Methods

Participants

We report on a subset of data collected as part of a larger study examining parent and youth indicators of diabetes management. We recruited participants from two pediatric diabetes centers in the mid-western United States. Eligible youth had a type 1 diabetes mellitus (T1DM) diagnosis of greater than 6 months, were between 10–16 years old, and were English speaking. Exclusion criteria included a diagnosis of developmental delay (i.e., autism, cerebral palsy, or mental retardation), as well as any psychiatric hospitalization within the last year. Of the 135 youth recruited (89% recruitment rate), 129 completed study measures and youth's HbA1c and self-monitoring blood glucose (SMBG) were obtained for 126 and 124 youth, respectively.

Procedure

Participants completed all study measures on a tablet during their scheduled clinic appointment and were compensated $25. As part of the routine care, youth had a HbA1c performed and their meter downloaded. We extracted these data from the electronic medical record for study use. Depending on clinic location, youth's HbA1c were measured on either the Tosoh G8 HPLC (Tosoh Bioscience Inc., San Francisco, California) or the Afinion

AS100 Analyzer (Orlando, Florida). Both instruments are traceable to the Diabetes Control and Complications Trial (DCCT) standard (12). The institutional review boards at both of the participating hospitals approved all study procedures prior to participant recruitment.

Measures

The Diabetes Family Conflict Scale (DFCS-R) (2) is a 19-item measure of diabetes-related conflict in the home. Youth rated items on a 3-point scale ranging from 1 (*almost never*) to 3 (*almost always*), with higher scores indicative of higher levels of perceived conflict. The DFCS-R had an internal consistency of .96 in this study.

The Self-Efficacy for Diabetes Scale (SED) (13) is a 35-item measure of youth's perceived confidence and ability to manage diabetes in three domains: diabetes-specific situations, medical situations, and general situations. Participants rated items using a 6-point scale ranging from 1 (*very sure I can't)* to 6 (*very sure I can)*. We used the total score in the present analysis; the internal consistency was .87.

We calculated youth's average daily SMBG from meter downloads using 14 consecutive days of SMBG.

Analytic Plan

We examined whether youth's self-efficacy for diabetes management moderates the associations family conflict has with SMBG and glycemic control by conducting a series of hierarchical multiple regression analyses in which SMBG and HbA1c were regressed onto family conflict, self-efficacy for diabetes management, and age. We included youth's age because of previous evidence showing an association between age, SMBG, and HbA1c (9; 14). We centered all predictor variables for the purpose of testing two-way interactions (15). We entered main effect terms for family conflict, self-efficacy for diabetes management, and age in Step 1 and the two-way interaction of the main effect terms for family conflict and self-efficacy in Step 2. We examined significant interactions using simple slopes and used values that were one standard deviation above the mean to represent high family conflict and one standard deviation below the mean to represent low family conflict (15).

Results

Youth had a mean time since diabetes diagnosis of 5.57± 3.39 years and mean age of 13.57±1.81 with the majority identifying as male (N = 70; 54.3%) and Non-Hispanic White (N = 113; 87.6%). At the time of data collection, the HbA1c target for youth between 8–13 years old was < 8.0% and it was < 7.5% for youth between13–17 years old (16). Youth's mean HbA1c value was 9.2+2.1% (range: 5.2–15.3%), which was above both of these age-based targets. Youth's mean daily SMBG was 3.80+2.07 (range: 0–9.2). Youth reported a mean level of family conflict of 31.02+11.27 (range 19–57; 9% of the sample with reported levels of family conflict one standard deviation below the mean and 20.1% reported levels one standard deviation above the mean). For self-efficacy for diabetes management, youth reported a mean of 167.46+19.63 (range 117–208; 17.2% of the sample with self-efficacy scores one standard deviation below the mean and 17.2% with scores one standard deviation above the mean).

Prior to conducting our primary analyses, we screened the data for outliers, which resulted in the removal of one univariate outlier. We present the results of the hierarchical multiple regression analyses in Table 1.

Self-monitoring blood glucose.

Results found a significant two-way interaction between family conflict and self-efficacy (β = −.186, $t = -1.977$, $p = .05$). We present the predicted values for this interaction in Panel A of Figure 1. Simple slopes found that the slope of the line representing the associations between self-efficacy and SMBG was significant for those with low levels of family conflict (β = .283, $t = 2.269$, $p = .03$) but not for those with high levels of family conflict (β = −.066, $t = -.545$, $p = .59$). These results suggest that youth with a supportive family environment and high self-efficacy demonstrate high rates of SMBG.

HbA1c.

Our results found a main effect for self-efficacy (β = −.320, $t = -3.979$, $p \leq .001$) that was qualified by the two-way interaction between family conflict and self-efficacy (β = −.210, $t = -2.50$, $p = .01$). We present the predicted values for this interaction in Panel B of Figure 1. Simple slopes tests found that the slope of the line representing the associations between youth's self-efficacy and HbA1c was significant for those with high levels of family conflict (β = −.507, $t = -4.667$, $p \leq .001$) but not for those with low levels of family conflict (β = −.107, $t = -0.928$, $p = .36$). These results suggest that youth who experience high family conflict and have low self-efficacy for managing their diabetes are at risk for poor glycemic control.

Conclusions

In a sample of youth with T1DM, we examined the associations between family conflict, youth self-efficacy, and either frequency of SMBG or youth's HbA1c levels based on the hypothesis that youth self-efficacy would moderate the relationships between family conflict and youth's adherence and health outcomes. Self-efficacy for diabetes management characterizes youth's perceived ability to engage in health promoting behaviors consistent with T1DM management (17; 18). In the case of SMBG, our results found that high youth self-efficacy was associated with more frequent SMBG only in the context of low family conflict. Indeed, we found less frequent SMBG in youth from a high conflict family environment even if youth also possessed high self-efficacy and SMBG levels that were comparable to youth reporting low self-efficacy and low family conflict. Taken together, these findings suggest that SMBG may be a particularly challenging diabetes management behavior that necessitates both a supportive family environment and competence for diabetes management to attain optimal adherence in adolescence. These findings align with recommendations for collaborative T1DM self-care for adolescents, which suggest that parents should facilitate adolescents' sense of autonomy by providing the appropriate amount of support needed for diabetes management (19). In contrast, the results examining the association between family conflict and HbA1c supported a buffering effect of self-efficacy. More specifically, family conflict surrounding diabetes management was associated with poorer HbA1c levels for youth with low self-efficacy but not for those with high self-efficacy. In fact, youth with high self-efficacy and high levels of family conflict

demonstrated HbA1c levels that were similar to youth with low levels of family conflict. One possible explanation for the associations found for HbA1c is that youth with high self-efficacy may be better able to follow through with diabetes self-care despite their high conflict family environment because they are confident in their capabilities and more likely to persevere when faced with environmental challenges.

Our results extend previous study findings (8; 20) by providing a more nuanced perspective of the relations among the variables. While previous studies have generally concluded that diabetes-specific family conflict negatively influences adherence to SMBG, which, in turn, has negative consequences for glycemic control, the present study extends these findings by examining the moderating role of youth's self-efficacy in the associations between family conflict and SMBG and HbA1c. Moderation models examining the interrelations between individual (i.e., youth's self-efficacy) and family (i.e., family conflict) factors may provide a better understanding of the complex relationships among various systems-level factors known to influence diabetes management outcomes (21–23). Further, knowledge of the intersection between individual and family factors may aid in the development of more appropriate prevention and intervention strategies. For example, our findings suggest that interventions aimed at improving SMBG may benefit from targeting family conflict prior to youth's self-efficacy, given that high self-efficacy does not appear to improve SMBG in high conflict environments.

Despite the strengths of the present study (e.g., objective assessment of SMBG and HbA1c), it does has some limitations. First, the cross-sectional nature of the data does not allow for causal inferences. Future longitudinal studies are necessary to establish temporal associations among study variables. Second, the study comprised a relatively homogenous sample of youth with T1DM, the majority of whom self-identified as Non-Hispanic White. While this sample is largely representative of the U.S. population of youth with T1DM, these data many not generalize to a more ethnically diverse sample. Third, the study relied on self-report measures of diabetes-related family conflict and self-efficacy for diabetes, which may introduce biases owing to limits of youth's memory and perceptions. Furthermore, it is possible that common method variance accounts for some proportion of the relations found between family conflict and self-efficacy. Additionally, it is notable that some of the items on the SED appear outdated for use with pediatric T1DM populations on contemporary diabetes management. Thus, additional research is necessary to replicate the present results as well as to examine how to best adapt the SED for contemporary diabetes management in order to maximize reliability and validity. Fourth, the use of a central lab for HbA1c assays would provide a more standardized assessment of youth's HbA1c across study site. Fifth, we used the most recent 14 days of data to calculate SMBG, which may be subject to white coat adherence bias. Although recent research shows that white coat adherence in the context of SMBG is largely limited to young children (24), future research should examine the present findings with SMBG data over an extended time.

In conclusion, the present study reports on the interactive effects of diabetes-specific family conflict and self-efficacy in relation to SMBG and glycemic control. Study findings highlight the importance of not only assessing for these variables but also their synergistic relationship for understanding factors that facilitate and impede successful diabetes

management in youth with T1DM. Implications of these findings extend to both assessment and treatment. For instance, when identifying barriers to effective diabetes management, clinicians should assess for family functioning surrounding diabetes-management as well as youth's confidence in managing their diabetes. Furthermore, findings indicate that family functioning and youth's competence in managing their diabetes are promising treatment targets for families having trouble with SMBG and HbA1c.

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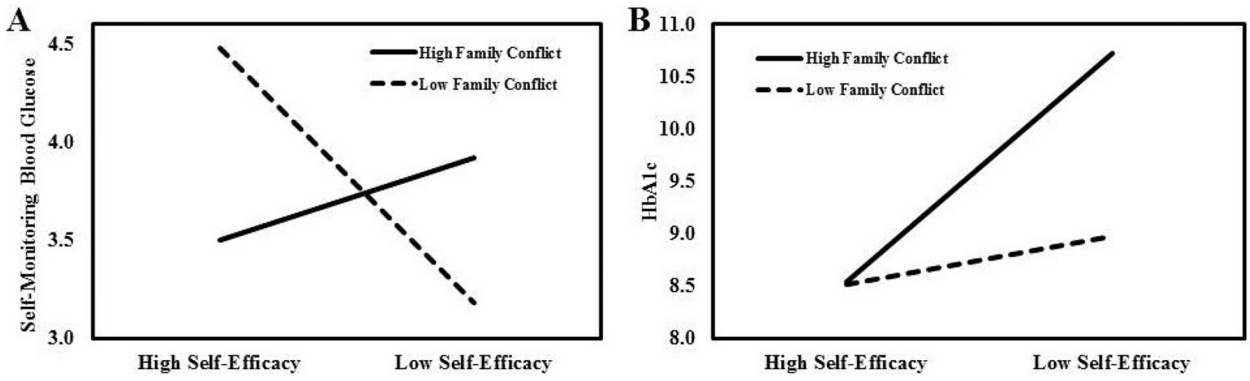

Figure 1.

Predicted values for Self-Monitoring Blood Glucose (Panel A) and HbA1c (Panel B) illustrating the interaction of level of family conflict and self-efficacy at values that are one standard deviation above and below their respective means.

Table 1.

Regressions of Self-Monitoring Blood Glucose and HbA1c on Family Conflict and Self-Efficacy for Diabetes Management.

	Self-Monitoring Blood Glucose			HbA1c		
	R^2	ΔR^2	β	R^2	ΔR^2	β
Step 1	.12***	.12***		.23***	.23***	
Age			−.36***			.41***
DFCS-R			−.10			.13
SED			.10			−.32***
Step 2	.14***	.02*		.26**	.03**	
Age			−.35***			.42**
DFCS-R			−.02			.21*
SED			.11			−.31***
DFCS-R x SED			.19*			−.21**

Note. DFCS-R = diabetes family conflict; SED = self-efficacy for diabetes management.

* $p < .05$;

** $p < .01$;

*** $p < .001$