Child Routines and Youths’ Adherence to Treatment for Type 1 Diabetes

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Objective Type 1 diabetes (T1DM) is a chronic life-threatening disease that requires strict adherence to daily treatment tasks. Although necessary for survival, children who present with behavior problems tend to show problems complying with the treatment regimen, thereby increasing their risk for morbidity and premature mortality. The risk of poor treatment adherence is hypothesized to be lower for these children, however, if they engage in more routine behaviors. Given the potential clinical implications, this hypothesis and two theoretical models proposed to elucidate the underlying psychological process for the role of child routines in treatment adherence were evaluated empirically. The first model hypothesized that child routines protect (moderator variable) behaviorally problematic children from poor treatment adherence, whereas the alternative model hypothesized that child routines mediate the relation between childhood behavior problems and poor treatment adherence.

Methods Parents of T1DM patients (N = 111) ranging from 6 to 16 years of age (M = 12 years) reported on their child’s behavior problems, routine behaviors, and adherence to treatment for T1DM using standardized measures. Baron and Kenny’s statistical procedures for testing moderation and mediation hypotheses were used to evaluate the proposed models.

Results Regression analyses did not support the moderation hypothesis but did support the hypothesis that engaging in child routines mediates the relation between childhood behavior problems and poor treatment adherence.

Conclusions Parents of behaviorally problematic children diagnosed with T1DM might be advised to instill routines in their child’s daily activities to increase the likelihood of treatment adherence, and thereby reduce the risk of morbidity and early mortality. Implications for clinical interventions are discussed.

Key words adherence; behavior problems; children; diabetes; routines.

Type 1 diabetes (T1DM) is a chronic childhood disease that is managed by a series of behavioral tasks including blood glucose monitoring as many as ≥4 times a day, administering insulin doses via injections or from an intravenous pump, exercising regularly, and complying with a dietary regimen. All of these tasks require daily attention while also considering the child’s body weight, age, and pubertal status (Silverstein et al., 2005; Wysocki, Greco, & Buckloh, 2003). Failure to comply with the prescribed regimen can cause serious short- and long-term medical complications including marked weight loss, delays in pubertal and skeletal maturation, nephropathy, hypertension, glycosuria, diabetic ketoacidosis, and hypoglycemia [Diabetes Control and Complications Trial Research Group (DCCT), 1993; Silverstein et al., 2005].

Although essential for establishing and maintaining optimal glycemic control, children and adolescents often feel overwhelmed by the complex and time-consuming treatment tasks required of them (Lemanek, Kamps, & Chung, 2001). Developmental issues, patient and family variables, features of the healthcare system, and disease characteristics can further undermine young patients’ efforts to follow their prescribed regimen (Antisdell & Chrisler, 2000; Cohen, Lumley, Naar-King, Partridge, & Cakan, 2004; Kovacs, Goldston, Obrosky, & Bonar, 1997).
Psychosocial factors such as childhood behavior problems pose particularly serious threats (Cohen et al., 2004; Kovacs, Charron-Prochownik, & Obrosky, 1995; Liss et al., 1998) because, as explained by family process theories, the unstructured home life that often accompanies childhood behavior problems can interfere with routinized behaviors (Hauser et al., 1990; Klemp & La Greca, 1987). This theory implies that living a more structured, routinized lifestyle might mitigate the negative impact of behavior problems on children’s adherence to the rigid treatment regimen that is prescribed for T1DM. There is growing support for this hypothesis as child and family routines have been linked to lower risks for childhood behavior problems (Fiese & Wamboldt, 2000; Moes & Frey, 2000; Stewart & Meyers, 2004).

Fiese and Wamboldt (2000) suggest that children naturally adopt routines and thus, can successfully make the transition to a daily treatment plan for a chronic illness with their family’s support and guidance. Routines are defined in this context as observable, repetitive interactions directly involving the child and one or more adults, occurring in a predictable and regular manner in the child’s daily or weekly life (Sytsma, Kelley, & Wymer, 2001). Such behaviors are recognized by their continuity, consistency, and little afterthought (Fiese et al., 2002). Some routines may take on ritual significance across the lifespan; however, such symbolic meaning is not necessary for fostering treatment adherence (Denham, 2003). Examples of child routines include eating meals regularly as a family, daily chores and homework, and bedtime routines. Given the number of daily treatment tasks required to manage T1DM, it seems intuitive that living a more routinized lifestyle would be conducive for increasing treatment adherence. Although not evaluated directly with youths diagnosed with T1DM, there is evidence that adolescents are in worse glycemic control during the summer months when they have less consistent daily routines (Boland, Grey, Mezger, & Tamborlane, 1999).

Although it is hypothesized that children who exhibit ongoing behavior problems are less likely to follow a medical regimen because they lack daily routine behaviors (Kovacs et al., 1995; Liss et al., 1998), this hypothesis has never been tested empirically. Hence, the purpose of the present study was to test the hypothesis that engaging in child routines is related to better treatment adherence among pediatric diabetes patients who also present with behavior problems. More specifically, we propose and tested two theoretical models that might elucidate the underlying process for how child routines influence behaviorally problematic youths’ risk for poor treatment adherence. The first model hypothesized that engaging in child routines is a protective factor (moderator variable) for behaviorally problematic children’s risk for poor treatment adherence; whereas the second model proposed that engaging in child routines mediates the relation between childhood behavior problems and poor treatment adherence. Although both models explain the role of child routines, each explains the nature of the role of routines differently. The first model conceptualizes child routines as a moderator variable; that is, engaging in child routines accounts for the strength or direction of the relation between behavior problems and treatment adherence (Baron & Kenny, 1986). Perhaps, for example, the relation between behavior problems and poor treatment adherence is stronger for youths who lack routines than for those who engage in more daily routine behaviors. The second model conceptualizes child routines as a mediating variable; that is, engaging in child routines explains how and why behavior problems may be related to treatment adherence (Baron & Kenny, 1986). Childhood behavior problems, for example, might interfere with establishing routines, which subsequently precludes treatment adherence.

In addition to the potential theoretical implications, testing these two models offers important clinical implications. Support for the mediation hypothesis, for example, would imply that behavioral interventions that focus on increasing the frequency of the patient’s nondiabetes-related routine activities might promote treatment adherence. Support for the moderation hypothesis would not necessarily offer direct clinical applications per se, but could aid with identifying risk factors for poor treatment adherence which, in turn, could lead to further hypotheses about possible mediators (e.g., parental supervision) that could subsequently reveal directions for clinical interventions (Baron & Kenny, 1986).

Factors that influence the adoption and frequency of child routines are important as they can influence interventions targeting such behaviors. One such factor that intuitively would be expected to affect routine practices is culture. Children from different cultures may exhibit fewer or more routine behaviors because their culture reinforces or dissuades them for engaging in such behaviors. Cross-cultural studies conducted to date suggest that cultures may differ in the expression of routine behaviors (e.g., conversations during family meals; Fiese et al., 2002), but that routines are equally therapeutic for curtailing emotional and behavioral problems across different racial/ethnic groups.
(Brody & Flor, 1997; Loukas & Prelow, 2004). Although noteworthy, we are unable to infer from the current literature if there are racial/ethnic differences in the frequency of child routines or about the relation between culture, child routines, and health practices (Denham, 2003).

Research on possible racial/ethnic differences in treatment adherence suggests that African-American youths may be at a greater risk for poor adherence to T1DM treatment than White youths (Auslander, Thompson, Dreitzer-White, & Santiago, 1997; Delamater et al., 1999). However, this finding has not necessarily been borne out in other studies (Harris, Greco, Wysocki, Elder-Danada, & White, 1999). Rather, there tends to be more consistent empirical support for racial/ethnic differences in glycemic control, with African-American youths showing a tendency to be in poorer metabolic control than White youths (Auslander et al., 1997; Davis et al., 2001; Delamater et al., 1999).

In summary, the goal of the present study was to evaluate two conceptual models hypothesized to explain the role of child routines in relation to childhood behavior problems and T1DM treatment adherence. The first model—a moderation model—hypothesized that the strength and/or direction of the relation between childhood behavior problems and treatment adherence is influenced by child routines. The second model—a mediation model—hypothesized that exhibiting childhood behavior problems is related to poor treatment adherence through the lack of routines in a child’s daily life. Both of these models were evaluated using the analytic procedures recommended by Baron and Kenny (1986) for testing moderation and mediation models. We also included a representative number of African-American and Caucasian youths to maximize the opportunity to examine possible racial/ethnic differences in the frequency of routines and adherence behaviors.

Although there is empirical evidence that medical patients who follow a more routine schedule are generally more compliant with their treatment regimen than patients who lack routines (Boyle et al., 1977; Bush & Pargament, 1997; Fiese & Wamboldt, 2000; Moe & Frea, 2000; Ryan & Wagner, 2003), this is the first study known to date that attempted to examine the underlying psychological process for this relation with a pediatric diabetes population. In addition to the theoretical implications, the present findings offer important clinical implications including directions for improving treatment adherence among youths diagnosed with a life-threatening disease that requires intensive daily treatment for survival.

Method

Participants

Participants included parents accompanying their child for a routine appointment at a university-affiliated pediatric diabetes clinic. Exclusion criteria included (a) child diagnosed with T1DM ≤12 months, (b) child diagnosed with a comorbid chronic illness or type 2 diabetes, (c) child diagnosed with mental retardation, (d) the child attended the medical appointment alone or with someone other than a parent/legal guardian, and (e) the child < 6 years of age. Two of the 116 parents invited to participate declined, citing lack of interest as the reason. Of the 114 patients who participated, 3 parents had incomplete data leaving a total of 111 participants.

The children ranged from 6 to 16 years of age (M = 12.30; SD = 3.69). Slightly more than half were female (55%) and approximately two-thirds were African-American (64%). The remaining participants were Caucasian. Seventy percent of the children were receiving Medicaid and 30% had private insurance. Most of the respondents were mothers (n = 87; 78%). The remaining respondents were either fathers (n = 10; 9%) or another family member who had legal custody of the child (n = 14; 13%). The mean length of time since the child was diagnosed with T1DM was 4.37 years (SD = 3.29). Most of the children and adolescents were treated with daily insulin injections (75%) and the remaining youths were treated with a subcutaneous insulin pump (25%). The sample composition was representative of the families treated in the clinic. Comparisons between participants and the families that participated, but were excluded from analyses because of incomplete data, revealed that there were no significant differences on the child’s age and length of time since diagnosis, $F(1,112) = .34$ and .39, respectively, $p > .05$, as well as the child’s gender and race/ethnicity, $\chi^2 (1, N = 114) = 2.85$ and .60, respectively, $p > .05$.

Measures

Self-Care Inventory (SCI)

The SCI is a 14-item measure of adherence to treatment for T1DM, based on recommendations from the American Diabetes Association. Items refer to blood glucose monitoring, insulin administration, dieting, and exercising. Each item is rated on a 5-point Likert scale ranging from 1 (never do it) to 5 (always do as recommended without fail). Item responses are summed and then averaged to obtain an overall index of adherence. The SCI has been found to be internally consistent and
correlates with metabolic control as well as interview measures of adherence (Greco et al., 1990). The measure was also found to be internally consistent with the present sample, Cronbach $\alpha = .78$.

**Pediatric Symptom Checklist (PSC)**
The PSC is a 35-item screening measure for emotional/behavioral problems in children and adolescents (Murphy et al., 1996). Parents rate the frequency of 35 problem behaviors on a 3-point scale ranging from 0 (never) to 2 (often). A sum score of 28 or greater suggests significant psychosocial impairment for children between 6 and 16 years of age. The PSC has high internal consistency, Cronbach $\alpha = .89$ and .91 (Jellinek & Murphy, 1988; Stoppelbein et al., 2005), and good reliability, $r$'s = .77 to .91 (Murphy et al., 1996; Stoppelbein et al., 2005). Internal consistency was high with the present sample as well as comparable to other reports, $\alpha = .89$.

**Child Routines Questionnaire (CRQ)**
The CRQ is a 39-item parent-report measure of the degree of routines in a child’s daily activities. Items include routine behaviors that children and adolescents commonly exhibit in their daily lives (e.g., eating meals, homework, chores, personal hygiene, etc.). The CRQ has good test-retest reliability, $r = .86$, and high internal consistency, Cronbach $\alpha = .90$ (Sytsma et al., 2001). Internal consistency for the present sample, $\alpha = .95$, was found to be comparable to findings reported for the validation sample.

**Glycosylated hemoglobin (HbA1c)**
Although not a focus of the study, HbA1c was used as an index of the child’s mean blood glucose level for the past 2–3 months. Blood assays were evaluated using the DCA 2000 analyzer. HbA1c values can range from <2.5 to >14% and a normal range for patients seen in the clinic is 4.4–8%. Values exceeding 8% reflect poor glycemic control. HbA1c was included in analyses for descriptive purposes only.

**Procedure**
Parents of youths attending a routine medical appointment at a university-affiliated pediatric diabetes clinic completed a standard set of paper-and-pencil measures as part of the child’s multidisciplinary assessment. The parents were informed that their completion of the measures was voluntary and would aid with making recommendations for improving their child’s diabetes care. Institutional Review Board approval was obtained to analyze the clinic data prior to conducting analyses.

**Statistical Analyses**
Correlational analyses were conducted to test for multicollinearity among the demographic and disease-related variables and the variables of interest. Demographic and disease-related variables (i.e., child’s age, gender, race/ethnicity, and the length of time since the child’s medical diagnosis) that have been found to be related to treatment adherence in previous research were selected for inclusion in analyses (Auslander et al., 1997; Delamater et al., 1999; Hanson, De Guire, Schinkel, & Kolterman, 1995; Miller-Johnson et al., 1994; Palardy, Greening, Ott, Holderby, & Atchison, 1998; Stewart et al., 2003; Wiebe et al., 2003; Wysocki & Gavin, 2006). The variables of interest for testing the two proposed conceptual models included childhood behavior problems, child routines, and treatment adherence. The PSC, CRQ, and SCI were used to measure these three variables, respectively, because they are commonly used and well validated measures of the constructs. Glycemic control as measured by the child’s HbA1c was included in analyses for descriptive purposes only.

Regression analyses were performed to evaluate the two conceptual models proposed to explain how child routines influence the relation between childhood behavior problems and poor treatment adherence. Both models derive from literature indicating that children with behavior problems are at a greater risk for poor treatment adherence (Cohen et al., 2004; Kovacs et al., 1995; Liss et al., 1998). The first model—the moderation hypothesis—hypothesizes that engaging in child routines acts as a buffer or a moderator variable for the relation between childhood behavior problems and poor treatment adherence. The second model—the mediation hypothesis—hypothesizes that engaging in child routines mediates the relation between childhood behavior problems and poor treatment adherence. Age was included as a covariate in all analyses because it was found in preliminary correlational analyses to be related to treatment adherence (SCI).

To test the moderation model, the effect of the predictor variable (PSC; behavior problems) on the criterion variable (SCI; treatment adherence) was hypothesized to change linearly with respect to the moderator variable (CRQ; child routines). According to Baron and Kenny (1986), the linear hypothesis is evaluated statistically by dichotomizing the predictor variable (PSC) and adding the cross-product of the moderator variable and the dichotomous predictor variable (CRQ $\times$ PSC) to a regression equation that includes the predictor variable (PSC) and the moderator variable (CRQ) as predictors of the criterion variable (SCI). The predictor variable (PSC)
was dichotomized at the median split for the present analyses. A significant moderator effect is indicated by a significant effect for the interaction term (CRQ × PSC) while the predictor (PSC) and moderator (CRQ) variables are controlled statistically.

The second conceptual model—the mediation hypothesis—was also evaluated using analytic procedures recommended by Baron and Kenny (1986). A total of four regression equations were tested that included first, regressing the criterion variable (SCI) on to the predictor variable (PSC). Second, the mediator variable (CRQ) was regressed on to the predictor variable (PSC). Third, the criterion variable (SCI) was regressed on to the mediator (CRQ). And finally in the fourth step, the criterion variable (SCI) was regressed on to the predictor variable (PSC) and the mediator variable (CRQ) simultaneously. Support for a mediating effect occurs when (a) the predictor variable (PSC) is significantly related to the criterion variable (SCI) in the first regression analysis, (b) the mediator (CRQ) is significantly related to the predictor variable (PSC) in the second regression analysis, (c) the mediator variable (CRQ) is significantly related to the criterion variable (SCI) in the third regression analysis, and (d) when paths (a) and (b) are controlled in the fourth regression analysis, the previously significant relation between the predictor (PSC) and the criterion (SCI) variables is no longer statistically significant (Fig. 1). There is evidence of complete mediation if the relation between the predictor (PSC) and criterion (SCI) variables is zero after controlling for the mediator variable (CRQ) in the fourth regression analysis. If the relation only declines, then there is support for partial mediation. A Sobel (1982) test is conducted to determine if the mediation effect is statistically significant. Due to skewed data, the SCI and CRQ scores were logarithmically transformed to approximate normal distributions.

## Results

### Descriptive Statistics

The children’s mean and median HbA1c was 9.31% (SD = 2.20; range = 4.9 to >14%); the modal level was 8.10%. The mean value is above the range recommended for good glycemic control but is comparable to averages reported in other studies (Cohen et al., 2004; Daviss et al., 1995; Hanson, Henggeler, & Burghen, 1987a; Leonard, Jang, Savik, & Plumbo, 2005; Liss et al., 1998; Stewart et al., 2003). The sample’s mean SCI score was 3.85 (SD = .66), which is also comparable to scores observed for other samples of youths (Sysmsa et al., 2001).

Correlational analyses (Table I) revealed that age was positively related to the length of time since diagnosis ($r = .31, p < .01$) and glycemic control (HbA1c; $r = .24, p < .01$), and negatively related to treatment adherence (SCI; $r = -.24, p < .01$). These findings indicate that older youths tended to be diagnosed with T1DM for a longer length of time, were in worse glycemic control, and were less likely to comply with their diabetes treatment regimen than younger youths do.

### Table I. Correlational Analyses

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Race/ethnicity coded 0 = Caucasian, 1 = African-American; PSC, Pediatric Symptom Checklist; CRQ, Child Routines Questionnaire; SCI, Self-Care Inventory. *p < .05, **p < .01.
Race/ethnicity was positively related to HbA1c ($r = .27$, $p < .01$), indicating that African-American youths tended to be in worse glycemic control than Caucasian youths. Behavior problems (PSC) were negatively related to child routines (CRQ; $r = -.36$, $p < .01$) and treatment adherence (SCI; $r = -.21$, $p < .05$), indicating that children with more behavior problems engaged in fewer routine behaviors and fewer treatment adherence behaviors. Child routines (CRQ) was found to be positively related to treatment adherence (SCI; $r = .49$, $p < .01$), suggesting that children who engaged in more routine behaviors tended to comply better with their T1DM treatment.

**Regression Analyses**

The regression equation testing the moderation hypothesis, that child routines is a buffer for behaviorally problematic children’s risk for poor treatment adherence, was found to be statistically significant, $F(4,107) = 10.49$, $p < .0001$, and explained 28% of the variance in treatment adherence (Table II). The interaction term, CRQ × PSC, was evaluated to determine if child routines (CRQ) is a moderator variable for the relation between behavior problems (PSC) and treatment adherence (SCI), and was not found to be statistically significant, $\beta = .27$, $p > .05$, while controlling for the main effects of age, behavior problems (PSC), and child routines (CRQ). This finding failed to provide empirical support for the moderation model that the level of child routines influences the strength or direction of the relation between childhood behavior problems and treatment adherence.

Tests for the mediation model revealed that (a) the predictor variable, behavior problems (PSC), was significantly related to the criterion variable, treatment adherence (SCI), $\beta = -.21$, $p < .05$, (b) the mediator variable, child routines (CRQ), was significantly related to the predictor variable, behavior problems (PSC), $\beta = -.36$, $p < .001$, (c) the mediator variable, child routines (CRQ), was significantly related to the criterion variable, treatment adherence (SCI), $\beta = .47$, $p < .001$, and (d) the relation between the predictor variable, behavior problems (PSC), and the criterion variable, treatment adherence (SCI), was no longer statistically significant, $\beta = -.05$, $p > .05$, when controlling for the relation between the mediator, child routines (CRQ), and the criterion variable, treatment adherence (SCI). Furthermore, the relation between the mediator, child routines (CRQ), and the criterion variable, treatment adherence (SCI), was statistically significant, $\beta = .46$, $p < .001$, while controlling for the predictor variable, behavior problems (PSC). The results support the hypothesis that child routines mediate the relation between childhood behavior problems and poor treatment adherence. A Sobel (1982) test of significance revealed that this effect was statistically significant, $t = 3.19$, $p < .001$.

**Discussion**

Treatment for T1DM requires strict adherence to a series of tasks including daily blood glucose monitoring, insulin administrations, dietary restrictions, and exercise. Although clearly therapeutic, children and adolescents do not routinely comply with their treatment tasks because of the complexity and demands of the tasks. Youths with behavior problems are especially at risk for poor treatment adherence because, according to family process theories, behaviorally disordered youths tend to lack routines in their lives, which is hypothesized to compromise their compliance with a multifaceted treatment regimen that requires daily attention (Fiese et al., 2002). Although intuitively informative, there has not yet been an empirical test of this hypothesis and of the possible models that might explain the underlying psychological process for the relation between childhood behavior problems, child routines, and treatment adherence. Hence, the purpose of the present study was to test two conceptual models—a moderation and a mediation model—proposed to explain the role of child routines in
behaviorally problematic children’s risk for poor adherence to T1DM treatment.

We did not find support for the hypothesis that engaging in child routines is a moderator variable but did find support for the mediation hypothesis that behavior problems may influence treatment adherence through child routines. As noted in the literature, children who lack routines tend to be at risk for more behavior problems (Fiese & Wamboldt, 2000; Moes & Frea, 2000; Stewart & Meyers, 2004), and as revealed by the findings indicating a mediation effect, are also at risk for poor treatment adherence. This finding is noteworthy from a clinical perspective because it suggests that clinicians might focus on encouraging behaviorally problematic youths to develop routine nondiabetes- as well as diabetes-related activities to maximize the likelihood of treatment adherence. Parental involvement is strongly recommended to maximize the therapeutic benefit of child routines because many of the routine behaviors that children engage in involve the parents and family (e.g., eating meals as a family). Furthermore, family members are powerful reinforcers and role models for adopting routine behaviors (Denham, 2003).

Fiese and Wamboldt (2000) offer specific therapeutic guidelines for teaching families how to establish a routine lifestyle including planning activities, being organized, involving multiple family members in routine activities, and being flexible to developmental changes in the family unit. It is also important that clinicians help families recognize the critical aspects of the child’s medical regimen, to identify someone to be responsible for each critical activity with the child (e.g., father and child), and to integrate the treatment plan into the child’s and family’s current routine activities. Some families already have established routines into which the diabetes treatment regimen can be integrated, whereas other families are disorganized and lack routines in their behavioral repertoire altogether. Each child and family should be evaluated before initiating therapy to determine their current level of routine practices (e.g., eating meals together regularly, etc.) and to select the most appropriate level of intervention. Such assessments should be conducted throughout treatment to evaluate the child’s progress and to identify obstacles to establishing routine behaviors.

Youths and families from lower socioeconomic (SES) groups may be particularly susceptible to barriers to developing a routine lifestyle because of secondary adversities that can interfere with following a routine schedule. Clinicians might focus instead on teaching youths and families that are plagued by multiple psychosocial stressors how to solve and manage problems and to refer them to social service agencies to help alleviate some of the psychosocial problems that might compromise their routine behaviors. Helping these children and their families establish some semblance of order and organization may also help prevent further stress in their lives (Fiese et al., 2002; Markson & Fiese, 2000; Steinglass, Bennett, Wolin, & Reiss, 1987). In addition to SES, clinicians might be aware of cultural practices that could influence the expression of child routines (Fiese et al., 2002). However, they may not need to be concerned about racial/ethnic differences in the frequency of routine behaviors, as we did not find a difference between African-American and Caucasian youths in their rate of daily routines. We did find a difference, however, in glycemic control, with African-American youths showing a tendency to be in worse glycemic control than Caucasian youths. This finding is consistent with similar reports in the literature (Auslander et al., 1997; Davis et al., 2001; Delamatter et al., 1999) and underscores the merit of biopsychosocial research investigating the processes underlying this health disparity.

Although not the focus of the present study, it is noteworthy that the magnitude of the correlation between glycemic control and treatment adherence was low. This observation is consistent with low and equivocal correlations reported in the literature (Allen, Tennen, McGrane, Affleck, & Ratzan, 1983; Cohen et al., 2004; Hanson et al., 1996, 1987a; Hanson, Henggeler, & Burghen, 1987b; Johnson et al., 1992; Kaufman, Halvorson, & Carpenter, 1999; Lewin et al., 2006; Littlefield et al., 1992; Pendley et al., 2002; Stewart, Emslie, Klein, Haus, & White, 2005; Stewart et al., 2003; Thomas, Peterson, & Goldstein, 1997; Weist, Finney, Barnard, Davis, & Ollendick, 1993; Wiebe et al., 2005), and illustrates how glycemic control may be influenced by multiple factors (e.g., emotional stress, insulin resistance, etc.; Amiel, Sherwin, Simonson, Lauritano, & Tamborlane, 1986; Hamilton & Daneman, 2002; Lewin et al., 2006; Wysocki et al., 2003). Despite this shortcoming, treatment adherence has clearly been linked to better health outcomes in youths diagnosed with T1DM and supports investigating effective approaches to promoting treatment adherence early in development (DCCT, 1994).

**Methodological Limitations**

Using parental reports of the child’s behavior, routines, and treatment adherence limits conclusions about the
findings because the parents may not necessarily be the most accurate informants for certain types of symptoms in their children. Furthermore, parents may lack sufficient knowledge about their adolescent child’s behavior because they may not be able to supervise them as closely as younger children. Another limitation is the study’s focus on children with diabetes. Hence, further research is recommended to help maximize generalizations to a cross-section of pediatric conditions and with using multiple informants.

The sample’s low SES raises questions about possible confounds including a greater risk for behavior problems because of secondary adversities. The children’s mean score for behavior problems, however, was in the nonclinical range, suggesting that the sample was not necessarily a biased one. Nevertheless, the sample’s low SES does preclude generalizing the findings to other SES groups. Further research is recommended with families from a broader range of SES groups to maximize generalizations.

Finally, the present cross-sectional design precluded conducting a true test of the mediation hypothesis and thus, inferring cause and effect conclusions. A true test would require testing patients at the time that they develop behavior problems and following them longitudinally to determine the impact of their behavior problems on routine behaviors and on their level of treatment adherence. Although causal inferences are precluded, the present findings offer empirical support for examining the relation among these variables longitudinally.

Conclusion

According to the present data, child routines may influence behaviorally problematic youths’ risk for poor adherence to T1DM treatment. Typically, treatments designed to reduce childhood behavior problems involve contingency management programs that target increasing the number of pro-social behaviors and decreasing the number of problematic behaviors that children exhibit. Perhaps children diagnosed with T1DM who exhibit behavior problems in addition to poor treatment adherence may benefit from a behavioral program that targets reducing their behavior problems and that also instills routine behaviors in their daily activities. Clinicians and parents are also encouraged to cultivate child routines early in development because it may reduce the risk for parent–child conflicts later in adolescence, which can further compromise treatment adherence (Dubas & Gerris, 2002).

Although living a more routinized lifestyle was found to mediate the relation between behavior problems and treatment adherence behaviors, engaging in child routines was not found to be related to glycemic control. Nevertheless, this finding does not minimize the importance of treatment adherence in attaining optimal glycemic control. Longitudinal research has borne out that strict adherence to T1DM treatment significantly reduces the risk of morbidity and early mortality among young patients (DCCT, 1993, 1994). Hence, identifying predictors of treatment adherence offers important short- and long-term health benefits for people with T1DM. Future research might include longitudinal studies testing child routines as a mediator variable for the relation between behavior problems and treatment adherence to maximize causal inferences. In the meantime, encouraging patients to establish daily routines may be one practical tool for parents and clinicians to utilize to promote treatment adherence early in development when long-standing healthcare habits are typically established.

Conflict of Interest: None declared.

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