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Social Support for Diabetes Illness Management: Supporting Adolescents and Caregivers

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Abstract

Objective—The aim of this research study was to examine the relationship between four sources of social support (support for the adolescent from family, support for the adolescent from friends, support for the caregiver from another adult, and support to the family from the health care provider) and adolescents' diabetes outcomes (illness management behavior and health status) using a diverse sample of urban adolescents.

Method—One hundred forty-one adolescents with insulin-managed diabetes and their primary caregivers completed questionnaires assessing social support and illness management behavior. Glucose meters were downloaded and hemoglobin A_{1c} assays were obtained. Structural equation modeling (SEM) was used to test a model social support informed by social ecological theory.

Results—The results of the SEM indicated that support for the caregiver from another adult was directly and positively related to support for the adolescent from family and indirectly related to better illness management. Support for the adolescent was directly related to better diabetes management and, through better management, to better diabetes health. Neither support to the family from the health care provider or support to the adolescent from friends were related to support for the adolescent or illness management.

Conclusion—This study identifies a novel target for social support intervention to improve adolescents' illness management behavior – the caregivers of adolescents with diabetes. By enhancing the social support caregivers receive from other adults in their lives, caregivers' ability to support their adolescent children with diabetes might also be improved and, in turn, adolescents' illness outcomes.

Keywords

social support; diabetes; illness management; adolescents; caregivers

INTRODUCTION

Insulin-dependent diabetes (IDDM) is a chronic metabolic disorder affecting roughly 3.2 of every 1,000 children under the age of eighteen in the United States and 5.6 of every 1,000 age twelve to seventeen.¹ Diabetes management involves a complex and demanding daily regimen of blood glucose monitoring, insulin administration, dietary regulation, and exercise; requiring daily motivation and self-control.² Non-adherence leads to poor glucose control and places the individual at risk for adverse complications as early as five years post-diagnosis³ making illness management a primary concern.

It is well documented that attention to illness management declines during adolescence.⁴ This decline has been linked to suboptimal metabolic control and increased diabetes complications.⁵ Adolescents with diabetes also have an increased prevalence of psychological and adjustment problems related to poor illness management as compared to healthy peers⁶. Declines in illness management during adolescence are also linked to factors such as premature autonomy for diabetes care.⁷ In the face of these vulnerabilities, social support for diabetes care may offer a protective function and help to improve illness outcomes.

From a social ecological perspective,⁸ the most influential sources of social support influencing adolescents' diabetes management are likely to be interactions that occur on a daily basis, primarily interactions with family and friends. More distal interactions, such as support the family receives from the health care providers or support caregivers receive from another adult, are less likely to directly impact adolescents' illness management behavior but may have an indirect influence. Social support may be particularly important for urban, low income and/or minority families who face multiple stressors that may interfere with diabetes care.⁹ However, the bulk of social support research on youth with diabetes has focused on suburban, majority adolescents and families.

Social support from parents and family

For children and adolescents, the instrumental support received from parents and family is the earliest and, arguably, most crucial source of support for diabetes management.^{10,11} Hence, parental support is the most widely studied source of social support for children and adolescents. Decreases in parental support as children progress through adolescence is well-documented. The bulk of research suggests that parents withdraw support primarily as a function of age and other markers of physical maturity rather than cognitive or emotional indicators of readiness to assume greater responsibility for diabetes.^{11,12} Decreases in parental support for diabetes, in conjunction with premature autonomy, are directly linked to poorer illness management.^{9,13} Researchers have been unable to connect parental support for diabetes to adolescents' diabetes health (metabolic control).¹⁴

Social support from friends and peers

For adolescents with a chronic illness, support from close friends and the broader peer group appears to represent an important source of emotional support that complements the instrumental support received from parents.^{15,16} While a few studies have shown higher levels of social support from peers is related to poorer diabetes outcomes,¹⁷ more often, researchers have not found significant relationships between friend support and diabetes management^{15,18,19} or diabetes health.²⁰ Therefore, data supporting the importance of peer support for promoting good diabetes care is lacking.

Social support for the caregiver

The provision of instrumental and emotional social support from another adult to the caregivers of adolescents with diabetes is likely to increase caregivers' ability to support their children and, thereby, enhance adolescents' likelihood of completing illness care. Despite the fact that caregivers of adolescents with diabetes report a need for support in caring for their chronically ill children²¹ and preliminary evidence that such support improves adolescents' illness management behavior^{22,23}, there has been little research examining the relationship between support for caregivers and adolescents' illness management. Furthermore, studies have targeted two-parent, higher SES families limiting our understanding of the impact of social support among urban families where caregivers may be single parents with limited resources.

Social support from the medical care provider

Because diabetes is a chronic illness for which adolescents and their caregivers must engage in routine medical care, the relationship the family has with the medical care provider is paramount for effective illness management. Emotional support from the medical care provider, such as empathy and praise, can decrease diabetes-related stress and increase adolescents' and caregivers' confidence and ability to complete diabetes illness management tasks. One qualitative study, conducted with adults with diabetes, found instrumental and emotional support from the health care provider led to mastery of illness management.²⁴ There is no research examining the relationship between support from the medical care provider and diabetes outcomes in children and adolescents.

Overall, the social support literature suggests that the impact of social support on adolescents' diabetes management and health outcomes is not fully understood. The needs of urban, minority adolescents are particularly overlooked as the bulk of research in this area has utilized suburban, majority samples. The aim of this study was to address this gap by examining the relationship between four sources of social support (support for the adolescent from family, support for the adolescent from friends, support for the caregiver from another adult, and support to the family from the health care provider) and adolescents' diabetes outcomes (illness management and diabetes health) using a diverse sample of urban adolescents. Social Ecological Theory⁸ provided a theoretical model for understanding how these sources of support might affect adolescent diabetes care. It was hypothesized that proximal supportive relationships, from family and friends, would be directly and positively related to adolescents' illness management. Distal support, support to caregivers from another adult and support from health care providers, were hypothesized to be indirectly, positively associated with adolescents' illness management behavior. Finally, it was hypothesized that adolescents' illness management would mediate the relationship between adolescents' perceptions of support and their diabetes health. Figure 1 presents the theoretical model for this study.

METHODS

Study Design

This research study was a secondary analysis of baseline data collected from 2007 to 2010 for an intervention study. The parent study was a randomized, controlled, repeated measures design testing the efficacy of Multisystemic Therapy (MST) to improve illness management behavior among high-risk adolescents with insulin-managed diabetes. A cross-sectional design using baseline data only was selected. The follow up data were not included in the analyses due to the fact that they reflected the effects of MST which directly targeted social support amongst other factors influencing illness management.

Participants

The study sample was comprised of 141 adolescents with insulin-managed diabetes (type 1 or type 2) and their primary caregivers. Participants were recruited from the diabetes clinics located within a large tertiary medical center in an urban, metropolitan area. Participants were 10 to 17 years of age with either type 1 or type 2 insulin-managed diabetes in chronically poor control. Poor control was evidenced by a hemoglobin A_{1c} (HbA_{1c}) greater than or equal to 8% at study entry and on average over the prior 12 months. Participants were not selected based on race or gender. However, African American adolescents are at increased risk for poor diabetes outcomes^{25,26} and the recruitment site serves a primarily African American population. Hence, African American adolescents represent a majority of the participants. Exclusion criteria were limited to mental health conditions that prevented patients from fully participating in the treatment intervention (e.g., moderate or severe mental retardation, thought disorders, suicidality, or homicidality) as well as co-morbid physical health problems that altered their diabetes management substantially from that of most children with diabetes (e.g., cystic fibrosis).

Of the 513 families screened for participation, 238 were ineligible and 36 could not be contacted. Of the remaining 239, 52 refused participation and 10 withdrew prior to randomization for a 26% refusal rate. The most commonly cited reasons for nonparticipation were a lack of interest and not having the time to devote to intervention services. The final sample consisted of 146 adolescents and their families, of which 141 are included in this study. Five adolescents on basal insulin only were excluded because their daily care regimen, and, hence, social support needs, was less demanding than the typical multiple injection/infusion pump regimens.

Table 1 presents the demographic profile of participants. Adolescents were primarily African American (77.3%, $n = 109$) with an average age of 14.1 ($SD = 2.28$) years at study entry. Just over half were female (56.0%, $n = 79$). The majority had been diagnosed with type 1 diabetes (92.9%, $n = 131$) for an average of 4.7 years ($SD = 3.05$). Most were on a basal-bolus injection regimen (58.9%, $n = 83$), a third were on a conventional mixed injection regimen (27.7%, $n = 39$), and 13.5% ($n = 19$) received their insulin via an infusion pump.

The primary caregiver, identified by families, was defined as the person who helps the adolescent the majority of the time with managing diabetes. The majority of primary caregivers were biological mothers (85.8%, $n = 121$) and more than half were single parents, (58.9%, $n = 83$) where single parent was defined as never been married, divorced, or widowed. Nearly half (48.9%, $n = 69$) reported annual incomes less than \$30,000 per year.

Procedures

Potential participants were initially approached in person by medical staff at the time of a regularly scheduled pediatric diabetes clinic visit or during an inpatient hospitalization. Research study staff followed up the initial contact and scheduled consent visits with families indicating an interest in participating. To increase participation and avoid barriers, such as a lack of transportation or childcare, all study visits occurred in families' homes. Questionnaire data were collected from both the adolescent and the primary caregiver, in separate rooms whenever possible. Data collection occurred prior to randomization; hence, the data collector was blind to participants' randomization status. This research was approved by the university human investigation committee where the research was conducted. All caregivers provided informed consent; adolescents 13 years and older provided written assent and adolescents under the age of 13 provided verbal assent.

Measures

Diabetes Social Support Questionnaire-Family—The *Diabetes Social Support Questionnaire-Family* (DSSQ-Family)²⁷ measured adolescents' perceptions of diabetes-specific support from family for diabetes management tasks. Five key areas were assessed with 32 items: eight assessed instrumental support related to insulin administration, twelve pertained to instrumental support for blood glucose testing, seven queried instrumental support for exercise, and five probed emotional support for diabetes care overall. Dietary items were excluded because the DSSQ-Family was developed prior to the widespread use of basal-bolus regimens and these items were not relevant for the majority of participants on intensive insulin therapy (71.6%, $n = 101$). Each item is presented using a two-part Likert scale format; the first part asked "How often does your family...", to which adolescents responded *never* (0), *less than two times a month* (1), *twice a month* (2), *once a week* (3), *several times a week* (4), or *at least once a day* (5). The second part asks the adolescents to rate the supportiveness of the behavior, "How supportive (helpful) is this to you?", using a three-point Likert scale, *not at all* (0), *somewhat* (1), or *very* (2). The frequency of each behavior was multiplied by its perceived supportiveness to calculate an individualized item score.²⁷ The mean of these individualized scores ranged from 0 to 15 with higher scores reflecting greater support. The DSSQ-Family total individualized summary score is a valid and reliable measure demonstrating face, content, concurrent, discriminant, and predicative validity as well as internal consistency, $\alpha = .98$.^{10,27} In the present study, Cronbach's alpha was .94.

Diabetes Social Support Questionnaire-Friends and -Parent—The *Diabetes Social Support Questionnaire-Friends* (DSSQ-Friends)¹⁸ is a parallel measure of diabetes-specific social support assessing adolescents' perceptions of their friends' support for diabetes management. For the present study, we adapted the DSSQ-Friend to evaluate social support to caregivers for adolescents' diabetes management from a single primary support person, the *Diabetes Social Support Questionnaire-Parent* (DSSQ-Parent). Both measures assessed the same five areas of diabetes care as the DSSQ-Family with 14 questions: two on insulin administration, five on blood glucose testing, four related to exercise, and 3 tapped emotional support. Adolescents were asked to think of "their friends" when responding; caregivers were asked to consider "the person who helps you the most with your teen's diabetes care". Caregivers identified their spouse or the child's mother/father in 35% ($n = 49$) of the cases, 29% ($n = 41$) identified another family member, 3% ($n = 4$) a family friend, and 33% ($n = 48$) reported no one helped them with their child's diabetes care. Both the DSSQ-Friends and the DSSQ-Parent were formatted and scored in a fashion similar to the DSSQ-Family. The DSSQ-Friend has established face, content, concurrent, and discriminant validity, test-retest reliability, and internal consistency ($\alpha = .94$).^{10,18} In the current study, both the DSSQ-Friends ($\alpha = .90$) and DSSQ-Parent ($\alpha = .91$) demonstrated good internal consistency. The DSSQ-Parent also demonstrated some evidence of the discriminant validity via a low level correlation with the DSSQ-Family ($r = .24, p < .01$) and MPOC-20 ($r = .18, p < .05$).

Measure of Process of Care—The *Measure of Process of Care* (MPOC-20)²⁸ assesses caregivers' perceptions of social support from their child's health care provider. Two levels of support were assessed: support from the health care professionals with whom the family interacts during medical visits (15 items) and support from the health care institution as a whole which may include anyone from hospital administrators to volunteer staff (5 items). Items ask caregivers to rate the health care provider's supportiveness using a 7-point Likert scale ranging from *not at all* (1) through to *a very great extent* (7): "To what extent do the people who work with your teen/the organization where you receive services...". A total summary scale was generated by calculating the mean response across all items where

higher scores reflect greater levels of support. The MPOC-20 is a valid measure with construct, concurrent, discriminant, and predictive validity as well as internal consistency, $\alpha = .83$ to $.90$.²⁸ In this study, the total summary scale indicated good reliability ($\alpha = .94$).

Diabetes Management Scale—Diabetes management is a multifaceted behavior that is difficult to assess.²⁹ Therefore, self-report and objective measures were collected. The *Diabetes Management Scale* (DMS)³⁰ is a self-report questionnaire designed to measure diabetes management in four key areas: insulin management, blood glucose monitoring, dietary management, and exercise. Like the DSSQ, the original DMS included a subset of dietary items that are not appropriate for adolescents on intensive regimens. Hence, respondents on traditional mixed injection regimens responded to 18 questions and those on basal-bolus regimens responded to 10 items. Regardless of insulin regimen, items asked respondents to report “What percent of the time do you...” using a 0–100% scale. A mean score reflected overall diabetes management with higher scores reflecting better illness management. The original instrument has established reliability and validity.^{31,32} Both parents and adolescents completed the measure, with parents reporting their perceptions of the adolescent’s illness management. The alpha coefficient for the version of the DMS used in the present study was .81 (mixed injections) and .71 (basal–bolus) for parent report and .60 (mixed injections) and .63 (basal–bolus) for adolescent report.

Blood Glucose Monitoring—To objectively assess illness management, data from adolescents’ blood glucose meters were downloaded to determine the frequency of *Blood Glucose Monitoring* (BGM). The average number of blood glucose tests per day performed over the 14-day period prior to the date of data collection was calculated.

Metabolic Control—Adolescents’ metabolic control was measured objectively via *Hemoglobin A_{1c}* (HbA_{1c}), an indirect and retrospective measure of average blood glucose levels over the previous two to three month period. In the current study, HbA_{1c} was obtained at baseline using the FDA-approved AccubaseA_{1c} test kit manufactured by Diabetes Technologies.³³ The Accubase test uses capillary tube blood collection instead of venipuncture making it appropriate for home-based data collection by non-phlebotomists. High performance liquid chromatography (HPLC) is used to analyze the blood sample. Comparability of HbA_{1c} obtained by the Accubase test system to HbA_{1c} obtained from venous whole blood has been established in several studies, including a sample of pediatric patients, $r = .987$.³³ Higher HbA_{1c} values indicate higher average levels of blood glucose which is indicative of poorer diabetes health status. Adolescents in this study had an average HbA_{1c} of 11.7% ($SD = 2.55$) reflecting very poor metabolic control as compared to clinical recommendations of ≤ 7.5 .³

Data Analysis Plan

Prior to analysis, missing data were estimated using the expectation-maximization (EM) algorithm of the missing values analysis module of Predictive Analytics Software Statistics (PASW Statistics), version 18.0. Questionnaire-level missing data ranged from 0% for the HbA_{1c} data to 2.8% ($n = 4$) for the blood glucose meter downloads. PASW Statistics was also used to conduct all descriptive and bivariate analyses.

Structural equation modeling (SEM) with Amos 19.0 was conducted to test the study hypotheses. The SEM model was evaluated using the following benchmarks: that the likelihood ratio χ^2 test of model fit was nonsignificant^{34,35,36}, the ratio of the χ^2 to degrees of freedom (df) ≤ 2 ³⁴, the comparative fit index (CFI) was $> .90$ ³⁷, and the root mean square error of approximation (RMSEA) was $< .08$ ³⁴. After establishing model fit, the adequacy of the measurement model was assessed by evaluating the factor loadings of each observed

indicator variable on its latent construct. Adequate factor loadings are at least .30 and roughly close in value to one another. The structural model was then assessed by examining the standardized parameter estimates. Nonsignificant paths were trimmed to improve model fit and to identify the most parsimonious model. The alternate model was compared to the theoretical model using the chi square difference test³⁸ and the Akaike information criterion (AIC)³⁴. The alpha level was set at .05 for all analyses.

RESULTS

Bivariate Analyses

Descriptive statistics and correlational analyses were conducted to test associations between variables; the results are presented in Table 2. Adolescents' perceptions of social support from family were related to all three measures of illness management such that higher levels of perceived support were related to higher levels of illness management: DMS-Teen ($r = .312, p < .001$), DMS-Parent ($r = .399, p < .001$), and BGM ($r = .250, p < .01$). Adolescents' perceptions of social support from friends, however, were unrelated to illness management at the bivariate level. Higher levels of support for the caregivers from another adult were associated with better adolescent-reported illness management on the DMS ($r = .225, p < .01$). Caregivers' perceptions of support from the health care provider were related to parent reported illness management on the DMS ($r = .295, p < .001$); higher levels of support were related to better illness management. Finally, better illness management was related to better adolescent health status across all three measures of illness management: DMS-Teen ($r = -.361, p < .001$), DMS-Parent ($r = -.237, p < .01$), and BGM ($r = -.431, p < .001$).

Associations among the demographic and study variables were also assessed. Younger adolescent age was related to higher levels of support for adolescents from family ($r = -.400, p < .001$) and for caregivers ($r = -.190, p < .05$), better illness management across all three measures [DMS-Teen ($r = -.260, p < .01$), DMS-Parent ($r = -.336, p < .001$), and BGM ($r = -.380, p < .001$)], and better adolescent health ($r = .287, p < .01$). Marital status was related to adolescent reported illness management such that youth in two parent families reported better illness management ($r = .227, p < .01$). Caregivers who were married or residing with a partner reported higher social support at the trend level ($r = .164, p = .051$). African American youth reported significantly poorer BGM ($r = .291, p < .001$) and higher HbA_{1c} ($r = -.306, p < .001$). Similarly, lower family income was related to poorer illness management for two of the three measures of illness management [DMS-Parent ($r = .184, p < .05$) and BGM ($r = .279, p < .01$)] and poorer adolescent health status ($r = -.247, p < .01$). Finally, adolescents on conventional mixed injection regimens had poor illness management via self-report and objective glucose meter downloads [DMS-Teen ($r = .252, p < .01$) and BGM ($r = .292, p < .001$)]. Caregiver age and adolescent gender were unrelated to the study variables.

Structural Equation Modeling

A structural equation model was fit to the variance/covariance matrix using a maximum likelihood solution to model relationships among variables. The theoretical model presented in Figure 1 was tested. This model had two exogenous, observed variables (support for the caregiver and support from the health care provider) directly predicting a latent construct, social support for the adolescent, and indirectly predicting a second latent construct, illness management behavior. Two indicator variables comprised the social support for the adolescent latent construct (DSSQ-Family and DSSQ-Friends) and three indicator variables (DMS-Teen, DMS-Parent, and BGM) comprised the illness management latent construct. Support for the adolescent was hypothesized to have direct effects on illness management and an indirect effect on adolescent health status (HbA_{1c}).

Four covariates were also included based on the results of the bivariate analyses. Caregiver marital status was added to control for the effects of having a partner residing in the home on support for the caregiver and adolescent illness management behavior. Adolescent age was added as a control for support for the caregiver, support for the adolescent from family, and illness management. Family income and adolescent race were strongly correlated ($r = .226, p < .01$); therefore, only one, income, was added as a control for illness management behavior. Insulin delivery regimen was also added to control for the effects of insulin delivery regimen on illness management. All demographic variables were allowed to covary.

This initial model demonstrated adequate model fit [$\chi^2(43, N = 141) = 70.380, p = .005$; CFI = 0.90; RMSEA = 0.07]; however, the social support to adolescent latent construct was under-identified as indicated by a low factor loading of social support to the adolescent from friends. Thus, this latent construct was replaced with a single observed variable, social support to the adolescent from family. All nonsignificant paths were also trimmed from the model, resulting in two additional observed variables, support from the health care provider and parent marital status, being removed from the final model. The alternative, trimmed model is presented in Figure 2.

The fit of the alternative, trimmed model was good [$\chi^2(24, N = 141) = 38.252, p = .033$; CFI = 0.93; RMSEA = 0.06]. Comparing the alternative model to the initial model, the alternative model was further supported by a significant chi square difference test³⁸ [$\chi^2(19, N = 141) = 32.128, p < .05$] and a smaller AIC value³⁴ (Model 1 = 164.380 versus Model 2 = 98.252), both of which indicate a better fitting model. All pathways were significant and Sobel's test of indirect effects suggested that both indirect effects were significant. Adolescents' perceptions of support from family mediated the relationship between support for the caregiver and adolescents' illness management behavior (2.69, $p = .004$) and adolescents' illness management behavior mediated the relationship between adolescents' perceptions of support from family and adolescents' health status (-3.31, $p < .001$). The final model explained 17% of the variance in illness management and 25% of the variance in adolescent diabetes health status.

DISCUSSION

This study introduces an innovative model of social support for adolescents with diabetes. Research to date has focused primarily on how two sources of social support, support from adolescents' family and support from adolescents' friends, impact adolescents' diabetes outcomes. Support from family and friends are the most logical sources of support to impact adolescents' daily diabetes care behaviors as these are the individuals with whom adolescents interact on a daily basis. This study took a broader look at the social ecology of adolescents with diabetes to include sources of social support more distal to adolescents, yet potentially influential in adolescents' daily diabetes care behavior: support for the caregiver from another adult and support from health care providers. These distal sources of social support were hypothesized to be indirectly, positively associated with adolescents' illness management behavior. The proximal sources of support, those that adolescents experience on a daily basis from family and friends, were hypothesized to be directly, positively related to illness management behavior. Adolescents' illness management behavior was hypothesized to mediate the relationship between support for the adolescent from family and friends and adolescents' diabetes health (Hba_{1c}).

The findings from the data analysis partially confirmed these hypotheses. The results suggested that support for caregivers from another adult was directly related to support for adolescents from their family and indirectly to adolescents' illness management behavior.

Support for adolescents from family was directly related to better diabetes illness management and, through better management, better diabetes health. These results are consistent with the limited literature on this topic. Specifically, two studies^{22,23} linked paternal support to adolescents' diabetes management behavior in middle class, two-parent, white families. This research extends these findings to a more diverse sample of primarily low-income, single-parent, minority families.

Few studies have examined the relationship between social support for the caregiver and children's illness outcomes. This may be due, in part, to the fact that more distal sources of social support, such as support for the caregiver, may not be directly related to children's illness outcomes but are rather indirectly related to illness outcomes through more proximal processes, such as enhancing the social support available to adolescents. Findings from Lewandowski & Drotar²² support this. In their study, spousal support for mothers was related to nurse reports of illness management but not objectively measured frequency of blood glucose monitoring. Although these two measures were highly correlated ($r = .45, p < .01$), nurses' report, a third-hand measure of illness management based primarily on adolescent and family self-report during clinical interactions, may have captured a construct related to, but distinct from adolescent illness management, such as family support. A model of social support similar to the one examined in this study, where social support for the caregiver is indirectly related to illness management, may have found a significant relationship between spousal support and blood glucose monitoring. Future longitudinal research is needed to further investigate the causal relationship between social support for the caregivers of adolescents with diabetes and adolescent's diabetes outcomes.

Also consistent with previous research findings was the lack of empirical support for the relationship between social support provided to the adolescent from friends and illness management.^{15,18,19} One plausible explanation for these findings could be that the adolescents in this study did not disclose their diabetes diagnosis to their friends, something many adolescents choose not to do because of peer pressure and a desire for acceptance, precluding their friends' ability to be supportive.¹¹ A related consideration might be the sampling procedures used in this study. The adolescents represented in this research study were a high-risk group targeted for an intervention study aimed at improving diabetes management behavior and, consequently, reported less of a connection to social support resources. A more diverse sample of adolescents with diabetes might demonstrate greater variability across all the social support measures. Future longitudinal research is needed to investigate the impact of social support for adolescents from friends on diabetes outcomes.

An unexpected finding in the present study was that caregivers' perceptions of support from the health care provider were not significantly related to adolescents' perceptions of support. There are several reasons that this may have occurred. First, it may be that interactions with the health care provider were too infrequent to have a significant impact. This is a plausible explanation given the fact that the families in this sample were very high risk, as indicated by adolescents' very poor health and living in primarily low-income, single parent households. Such families are more likely than others to miss regularly scheduled appointments^{39,40} and, as a consequence, caregivers might feel less connected to the health care provider. Although the data suggested caregivers had positive perceptions of the support they receive from the health care providers, the infrequency of interaction may have been a critical component. Future research examining the relationship between caregivers' perceptions of support, clinic attendance, and illness outcomes are needed to understand this relationship.

In addition, social support from the health care provider was assessed by caregivers alone. It is possible that the adolescents' perspective might be more strongly related to illness

management behavior. Furthermore, the lack of a relationship between social support from the health care provider and adolescents' friends might be related to the instruments themselves. The MPOC-20 and the DSSQ-Friends asks respondents to assess the overall support they receive from multiple health care providers/friends. Social support is likely located within specific relationships. For example, a caregiver may be more likely to feel supported by the nurse who she calls weekly to report blood glucose readings than other members of the health care team. An adolescent might be more likely to confide in one trusted friend about diabetes rather than all their "friends." Measures of social support that first identify an important support person within the health care team or friend network might better capture support for diabetes. Additional research is needed to develop instruments measuring perceptions of social support from specific individuals.

Youth enrolled in this study were primarily low-income, single-parented, urban African American youth targeted because of their poor illness management behavior and poor diabetes health status. This limits the generalizability of the study's findings to the broader population of youth with diabetes. The relationship between health care provider support and the outcome variables may have been similarly affected. Replication with diverse samples is needed. Furthermore, the use of cross-sectional data makes determining causal relationships difficult. Hence, the relationships posited should be confirmed using a longitudinal research design.

In conclusion, this study identifies a novel target for support intervention – the caregivers of adolescents with diabetes. Caregivers' ability to provide support to their adolescent children might be improved by enhancing the social support caregivers receive from other adults in their lives. Improvements in caregivers' support to their adolescent children might, in turn, result in improved adolescent illness management behavior and diabetes health.

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Figure 1.
Theoretical model of social support for adolescents' illness management behavior and health status.

Figure 2.

Final model of social support for adolescents' illness management behavior and health status (standardized regression weights). Model fit indices: $X^2(24, N = 141) = 38.252, p = .033$; CFI = 0.93; RMSEA = 0.06. Note: $*p < .05$, $**p < .01$, $***p < .00$

Table 1

Characteristics of Adolescents and their Caregivers (N = 141)

Adolescent Characteristics		% (N) or M (SD)
Race/Ethnicity	African American	77.3% (109)
	White/Caucasian	19.9% (28)
	Other Races	2.8% (4)
Gender	Female	56.0% (79)
	Male	44.0% (62)
Age at Study Entry		14.1 (2.28)
Diabetes Type	Type 1	92.9% (131)
	Type 2	7.1% (10)
Age at Diagnosis		9.4 (3.76)
Duration of Illness		4.7 (3.05)
Regimen	Conventional Mixed Injections	27.7% (39)
	Basal-Bolus Injections	58.9% (83)
	Insulin Infusion Pump	13.5% (19)
Caregiver Characteristics		
Relationship To Adolescent	Biological Parent	93.6% (132)
	Other	6.4% (9)
Gender	Female	91.5% (129)
	Male	8.5% (12)
Age		41.1 (7.76)
Marital Status	Single Parent Home	58.9% (83)
	Two Parent Home	41.1% (58)
Annual Income	\$29,999 or Less	48.9% (69)
	\$30,000 Or More	51.1% (72)

Table 2

Correlation Matrix and Distribution of Study Variables

	DSSQ-Family	DSSQ-Friend	DSSQ-Parent	MPOC-20	DMS-Teen	DMS-Parent	BGM	HbA _{1c}
DSSQ-Friend	.492***							
DSSQ-Parent	.275**	.140						
MPOC-20	.159 [†]	.095	.209*					
DMS-Teen	.312***	.145	.225**	.140				
DMS-Parent	.399***	.095	.126	.295***	.468***			
BGM	.250**	.148	.118	.063	.516***	.368***		
HbA _{1c}	-.060	.112	.021	.057	-.361***	-.237**	-.431***	
Adolescent Age	-.400***	-.108	-.190*	-.094	-.260**	-.336***	-.380***	.287**
Adolescent Race ^a	-.011	-.126	-.119	-.059	.154 [†]	.032	.291***	-.306***
Adolescent Gender ^b	-.012	.148	-.107	-.128	-.111	-.099	-.050	.132
Caregiver Age	-.007	.045	-.018	-.052	-.010	.032	.003	-.014
Marital Status ^c	.074	-.003	.164 [†]	.028	.227**	.109	.121	-.137
Annual Income ^d	-.019	-.059	.040	-.122	.161 [†]	.184*	.279**	-.247**
Insulin Regimen ^e	.034	-.011	.118	-.024	.252***	.099	.292***	-.113
M	4.28	4.25	3.52	5.27	67.99	67.96	2.40	11.64
SD	2.18	2.51	3.15	1.23	15.42	16.64	1.51	2.55

^a Child race dummy coding: 0 = African American, 1 = White/Other

^b Child gender dummy coding: 0 = male, 1 = female

^c Marital status dummy coding: 0 = single parent home, 1 = two parent home

^d Income dummy coding: 0 = less than \$30,000 per year, 1 = greater than or equal to \$30,000 per year

^e Regimen dummy coding: 0 = conventional mixed injection regimen, 1 = basal-bolus regimens

Note:

* $p < .05$,

** $p < .01$,

100% $p < .001$

5.0% $p < .075$
+