Journal of Family Psychology

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Online First Publication, September 5, 2011. doi: 10.1037/a0025259

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0893-3200/11/$12.00 DOI: 10.1037/a0025259

# Depleted Parental Psychological Resources as Mediators of the Association of Income With Adherence and Metabolic Control

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For adolescents with Type 1 diabetes, lower family income may be associated with poorer diabetes management through depleted parental psychological resources (i.e., higher parental depressive symptoms, lower parental acceptance). Adolescents ($N = 252$; 46% male) aged 10–14 years with Type 1 diabetes assessed the acceptance of their mother and father (e.g., "gives me the feeling that she likes me as I am"; "she doesn't feel she has to make me over into someone else"). Mothers provided information on family income and demographics. Both mothers and fathers reported their depressive symptoms. HbA1c scores were indexed via medical records. Lower family income was associated with higher (i.e., worse) HbA1c, more mother and father depressive symptoms, and less acceptance from both parents. Mediation analyses revealed that the relationship of lower family income with metabolic control occurred indirectly through lower maternal and paternal acceptance and lower adherence. Lower family income may impair the quality of parent—adolescent relationships that are beneficial for good diabetes management.

*Keywords:* adolescents, socioeconomic status, parenting, Type 1 diabetes

Adolescents with Type 1 diabetes struggle with the management of an intense daily regimen to maintain their health, which requires parental and financial support. Consistent with general trends in health disparities research, adolescents with Type 1 diabetes who experience lower family income have poorer metabolic control (higher HbA1c, Carter et al., 2008; Naar-King et al., 2006; Naar-King, Podolski, Ellis, Frey, & Templin, 2006; White et al., 2001). Resource models posit that the link between lower income and poorer health outcomes is due to a reduction in personal resources, such as experiencing more depressive symptoms (Gallo & Matthews, 2003), which may compromise the quality of parenting (Conger & Donnellan, 2007).

A large body of literature exists that has identified the link between low family income and poor health, and low family income and poor parenting. Conger and Donnellan (2007), argue that lower income may create a context of economic strain in which parents are at increased risk for depressive symptoms, which ultimately affect their ability to convey accepting relationships with their children. In the literature, low family income has been linked directly and indirectly to poorer health outcomes (Ashiabi & O'Neal, 2007) and more specifically to worse adolescent diabetes outcomes (Davis et al., 2001; Naar-King, Idalski et al., 2006). The present study drew on these broad models of income associations with health and development to understand the direct and indirect links between family income and diabetes management outcomes. Specifically, we examined whether the relationship between lower family income

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Portions of this work were presented at the meeting of the Society for Behavioral Medicine, Seattle, Washington, March, 2010. This study was supported by National Institute of Diabetes and Digestive Kidney Diseases Grants R01 DK063044-S1 and R01 DK063044. We thank members of the ADAPT research group for their valuable input and assistance during the development and execution of this project. We also thank the physicians and staff at the Utah Diabetes Center and Mountain Vista Medicine, as well as the adolescents and their families who participated in this study.

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and poorer metabolic control occurred through a process of depleted parental psychological resources including higher parental depression and poorer relationship quality between the adolescent and the parent, which undermined adolescent adherence.

It is important to note that associations between income and health outcomes are linear along the income gradient (Conger & Donellan, 2007) and are not confined to comparisons between children in poor versus nonpoor families. For example, even within a fairly constrained income range (e.g., low middle-income families to moderately low-income), children's health disparities have been observed (Larson & Halfon, 2010). Regarding chronic conditions such as diabetes, as income increases, the illness is less severe and better managed (Case, Lee, & Paxson, 2008). The national average income in 2008–2009 was under $50,000 (DeNavas-Walt, Proctor, & Smith, 2010). The linear association between income and health requires that our explanatory models be tested without selection for low-income populations.

Diabetes can be an expensive disease to manage, creating the possibility that low income has a fairly direct association with metabolic control. For example, good management (i.e., treatment adherence) requires continuous use of daily testing supplies as well as expensive equipment (e.g., glucometers, insulin pump) that can assist in the management of the illness, but that may not be fully covered by insurance plans. Parents with lower income have been observed to be less accepting, and adolescents who perceive their parents as less accepting have worse metabolic control (Davis et al., 2001; Diaz et al., 2000). The relationship between family income and poorer adolescent diabetes outcomes may also occur indirectly by depleting parental resources, affecting parental emotional well-being and the quality of parenting. For some parents, the daily struggles associated with economic hardship may result in parental depressive symptoms, which can disrupt effective parenting. The Resource Model of Gallo and Matthews (2003) and developmental models, specifically the Family Stress Model (Conger & Donnellan, 2007), support this statement and indicate that low family income may increase parental depressive symptoms, which can decrease parental acceptance.

There are data to support several links in the hypothesized pathway between lower income and poorer metabolic control through depleted parental psychological resources (i.e., higher depressive symptoms and lower acceptance) and poorer treatment adherence. Family income is negatively associated with depressive symptoms in mothers and fathers who may have difficulty in the quality of their parenting (Weissman, Paykel, & Klerman, 1972; Wilson & Durbin, 2010). Parental depressive symptoms have been associated with parental acceptance and were indirectly linked to poorer Hba1c through lower parental acceptance in adolescents with Type 1 diabetes (Eckshtain, Ellis, Kolmodin, & Naar-King, 2010). Prior diabetes research has observed a fairly consistent and positive relationship between having an accepting and communicative parent and better treatment adherence and metabolic control (Anderson, Ho, Brackett, Finkelstein, & Laffel, 1997; Drew, Berg, & Wiebe, 2010; La Greca, Follansbee, & Skyler, 1990; Miller-Johnson et al., 1994; Skinner, John, & Hampson, 2000). Families with lower income often lack acceptance in their parenting practices and lower-income adolescents who perceive their parents as critical and coercive have worse Hba1c than those who have an accepting relationship with their parents (Davis et al., 2001; Duke et al., 2008). Finally, a large literature supports links between adolescent adherence to the diabetes regimen and metabolic control (Hood, Peterson, Rohan, & Drotar, 2009).

The aim of the present study was to examine whether the income to HbA1c link was mediated by parental depressive symptoms, parental acceptance, and less treatment adherence. We used structural equation modeling (SEM) to test a path model examining the direct and indirect pathways between family income and HbA1c through a reduction in parental psychological resources (i.e., higher mother and father depression, lower mother and father acceptance). We hypothesized that lower family income would be: (a) directly related to higher (i.e., worse) Hba1c; (b) indirectly related to higher (i.e., worse) Hba1c through higher parental depressive symptoms, lower parental acceptance, and lower treatment adherence. Through the inclusion of both mothers and fathers, a comprehensive picture of family life and its association with Hba1c for adolescents with Type 1 diabetes was examined.

## Method

### Participants

Participants included 252 adolescents (M age = 12.49 years, *SD* = 1.53, 53.6% females) diagnosed with Type 1 diabetes, their mothers (M age = 39.64 years, *SD* = 6.34), and 188 fathers (M age = 42.08 years, *SD* = 6.32). Recruitment of participants occurred at a university/private partnership clinic (76%) and a community-based independent practice (24%) that followed similar treatment regimens and clinic procedures (e.g., similar insulin regimens). Eligibility criteria included that adolescents were between 10 and 14 years of age, duration of diabetes longer than 1 year (*M* = 4.13 years, *SD* = 3), able to read and write either English or Spanish, and living with mother. Parents gave written informed consent and adolescents gave written assent. The appropriate Institutional Review Board approved the study.

Of the qualifying individuals approached, 66% (a recruitment rate achieved likely due to the commitment required of a 3-year longitudinal study) of adolescents and mothers agreed to participate and filled out forms, of which 88% ($n = 219$) were married, remarried, or living with a partner and 12% ($n = 31$) were separated, divorced, widowed, or single. Comparisons of eligible adolescents who participated versus those who did not indicated that participants were older (12.5 vs. 11.6, $t(367) = 6.2$, $p < .01$), but did not differ on gender, pump status, Hba1c, or time since diag-

nosis (*p*s > .20). Adolescents were largely Caucasian (94%), English speaking ($n$ = 2 Spanish-speaking adolescents and parents), and middle class, with most (65%) reporting average annual household incomes of $50,000 or more annually. These demographics reflect the population of adolescents with Type 1 diabetes living in Utah and surrounding states, as well as the low incidence rates of Type 1 diabetes among minority youth. Approximately half (50.8%) of the adolescents were on an insulin pump, with the remainder being prescribed multiple daily injections (MDI). Mothers of adolescents on MDI reported physicians recommended an average of 4.14 insulin injections ($SD$ = 1.81, range: 0–10) and 5.53 blood glucose checks per day ($SD$ = 1.70, range: 1–11).

## Procedure

During recruitment at their diabetes clinics, participants received questionnaires to be completed individually prior to a laboratory appointment where they completed additional questionnaires. Questionnaire data were from adolescents' perspectives; mothers provided income, demographic, and maternal depression data, while fathers provided paternal depression data. The measures reported here contain only a subset of those included in the larger study; there is no overlap between the results reported in this study and other papers from the larger study (authors' citations).

## Measures

**Family income.** Mothers reported approximate household income, choosing income ranges in increments from "less than $5,000" to "$75,000 or more". The national average income in 2008 and 2009 was 49,777 (DeNavas-Walt et al., 2010). For the current sample, the average family income was in the 25,000–49,000 range (22.7%); 35.2% of the sample fell below the national average income. The distribution was < $5,000 (2%); $5,000–9,999 (2.9%); $10,000–14,999 (3.6%); $15,000–24,999 (4.5%); $25,000 – 49,999 (22.7%); $50,000–74,999 (28.7%); and > $75,000 (36%).

**Metabolic control.** Glycated hemoglobin (HbA1c) recorded in medical records at the recruitment visit indexed metabolic control. HbA1c is the medical standard for evaluating the quality of diabetes control, and reflects average blood glucose levels over the past 3–4 months (Bryden et al., 2001); higher values indicate poorer diabetes control. HbA1c was obtained using the Bayer DCA2000 by clinic staff. Participant authorization provided access to medical records to obtain HbA1c and other illness information (e.g., treatment regimen, etc.).

**Adherence.** Adolescents independently completed a 16-item Self Care Inventory (La Greca et al., 1990) to assess adherence to the diabetes regimen over the preceding month applicable to their regimen (1 = *never* to 5 = *always did this as recommended without fail*). Items were rephrased so that they were relevant to both regimens (i.e., using the insulin pump or not) such as bolusing (relevant to the insulin pump) or taking insulin (relevant to those not on the insulin pump). For the questions that were not applicable, adolescents were given a *not applicable* option. The scale was updated by adding two items to reflect current standards of diabetes care with the assistance of a certified diabetes educator (i.e., "How well have you followed recommendations for counting carbohydrates"; "How well have you followed recommendations for calculating insulin doses based on carbohydrates in meals and snacks"). Scores on this scale had good internal consistency ($\alpha$ = .85 in our sample) and correlate well with more time-intensive interview methods for measuring adherence (La Greca et al., 1995).

**Parental depressive symptoms.** The Center for Epidemiological Studies of Depression Scale (Radloff, 1977) measured mothers' and fathers' depressive symptoms during the past week (e.g., "I felt depressed") on a scale of 0 (*None/Rarely*) to 4 (*Most/All*); 16 and above are identified as clinically depressed. This measure had excellent reliability in our sample (mothers, $\alpha$ = .91, $M$ = 12.42, $SD$ = 10.04, range 0–45, 28.2% above cutoff; fathers, $\alpha$ = .90, $M$ = 9.01, $SD$ = 7.93, range 0–41, 17.8% above cutoff). This scale validly discriminates between psychiatric and nonpatient groups, and has been shown to be sensitive to difficulties in parenting a child with diabetes (Kovacs et al., 1990).

**Acceptance from mother/father.** Adolescents completed the Mother-Father-Peer Scale (MFP) from Epstein (1983), which consisted of five items that assessed the quality of the parent–adolescent relationship with regards to the degree to which the parent communicated love, acceptance, and appreciation of the child. For example, "Gives me the feeling that she likes me as I am; she doesn't feel she has to make me over into someone else" and "My mother/father enjoys being with me." Response choices ranged from 1 = *strongly disagree* to 5 = *strongly agree*. An average score across items was obtained. The scale demonstrated good internal consistency ($\alpha$ for adolescents' reports on mothers = .73, $\alpha$ for adolescents' reports on fathers = .83).

## Statistical Analysis

Data were analyzed using structural equation modeling (SEM) performed in EQS, version 6.1 (Bentler, 2005). To examine the associations among family income, parental depression, parental acceptance, and adolescents' adherence and metabolic control we estimated a path model. The goal of the analysis was to examine direct and indirect associations between income and diabetes outcomes. We hypothesized that lower family income would be directly related to higher (i.e., worse) HbA1c, and indirectly related through more mother and father depressive symptoms, lower mother and father acceptance, and lower treatment adherence. Model fit was evaluated using commonly accepted goodness-of-fit indices that are believed to function adequately for this sample size (Hu & Bentler, 1998; Marsh, Balla, & MacDonald, 1988). To determine significance of indirect paths, we used bootstrapped standard errors.

Before the SEM analysis, we screened our data for missing values and departures from normality. We detected significant multivariate non-normality (Mardia's normalized estimates >5, see (Bentler, 2005), and therefore we report robust fit indices and standard errors that have been corrected for non-normality (for details, see Bentler & Dijkstra, 1985; Satorra & Bentler, 1988). A mean (item) replacement strategy was used when individuals were missing less than 20% of the items for a particular scale. We used maximum likelihood estimation to handle the remaining missing data. We covaried out adolescent age, time since diagnosis, mothers' marital status, and use of an insulin pump on treatment adherence and HbA1c. Marital status was covaried to control for family status (i.e., single mother vs. intact family), which affects diabetes outcomes (Johns, Faulkner, & Quinn, 2008).

## Results

### Descriptive Statistics

Descriptive statistics and correlations among study variables can be found in Table 1. Lower family income was associated with higher (i.e., worse) HbA1c, more mother and father depressive symptoms, and lower levels of mother and father acceptance. Higher maternal depressive symptoms were associated with lower levels of mother and father acceptance, while paternal depressive symptoms were not associated with parental acceptance.

### Income–HbA1c Link Mediated Through Parental Depressive Symptoms and Acceptance

We tested a mediated path model of the direct association between family income and HbA1c, as well as the indirect association through the mediational pathway of parental depressive symptoms, parental acceptance, and treatment adherence. The model chi-square test was significant ($\chi^2$ Yuan-Bentler [27], $n = 252 = 43.786$, $p = .038$), which could suggest a poor-fitting model, but could also reflect the chi-square test's sensitivity to sample size (see Joreskog & Sorbom, 1993). Several goodness-of-fit indices have been recommended in addition to the chi-square statistic (e.g., Hu & Bentler, 1995; Marsh et al., 1988; MacCallum, Martin, & Thornton, 1996). Two of the most commonly used fit indices are the Comparative Fit Index (CFI) and the Root Mean Square Error of Approximation (RMSEA), which indicated excellent model fit ($\chi^2$ Yuan-Bentler [27], $n = 252 = 43.786$, $p = .038$; CFI = .984; RMSEA = .029), suggesting support for the model, though not all of the paths were significant (see Figure 1).

There was clear support for the first hypothesis that income would have a direct association with metabolic control, and partial support for the second hypothesis of an indirect association through parental depressive symptoms, parental acceptance, and treatment adherence. Lower family income was directly associated with higher mother ($\beta = -.412$, $p < .05$) and father depressive symptoms ($\beta = -.352$, $p < .05$), lower mother ($\beta = .182$, $p < .05$) and father acceptance ($\beta = .288$, $p < .05$), and higher (i.e., worse) Hba1c ($\beta = -.166$, $p < .05$). The direct path between lower family income and treatment adherence was not significant. However, lower family income was indirectly associated with lower treatment adherence through lower mother and father acceptance ($\beta = .111$, $p < .05$). This pattern suggests that the association of income with adherence was fully mediated by parental acceptance. The path model explained 16.9% of the variance of mothers' depressive symptoms, 12.4% of the variance of fathers' depressive symptoms, 4.7% of the variance in mothers' acceptance, 8.3% of the variance in fathers' acceptance, 21.4% of the variance in treatment adherence, and 21.5% of the variance in metabolic control.

Further analyses identified an indirect path between family income and metabolic control through parental acceptance and adherence. In the analyses of our second hypothesis, the indirect path from income to HbA1c was not significant. We hypothesized, however, that this reflected the shared variance of mother and father acceptance from the simultaneous analysis. That is, when mother and father acceptance were both in the model, the analysis examined only their unique variances, ignoring their shared variance and underestimating the total contribution of the indirect path through parental acceptance and adherence. To test this possibility, separate path models of mothers' depressive symptoms and acceptance and of fathers' depressive symptoms and acceptance were analyzed. In these separate models, lower family income was indirectly associated with poorer (i.e., higher) HbA1c through lower parental acceptance and lower adherence for both mothers ($\beta = .111$, $p < .05$) and fathers ($\beta = .111$, $p < .055$). These results suggest that lower income undermines mothers' and fathers' accep-

Table 1
*Correlations, Mean (M) and Standard Deviation (SD) Among Study Variables*

| | 2 | 3 | 4 | 5 | 6 | 7 | *M* | *SD* |
|---|---|---|---|---|---|---|---|---|
| 1. HbA1c | −0.31** | 0.20** | 0.18* | −0.14* | −0.22** | −0.31** | 8.38 | 1.58 |
| 2. Adherence | | −0.07 | −0.09 | 0.29** | 0.34** | 0.11 | 3.94 | 0.58 |
| 3. Depression (M) | | | 0.27** | −0.15* | −0.13* | −0.42** | 11.73 | 9.65 |
| 4. Depression (F) | | | | −0.06 | −0.08 | −0.30** | 9.59 | 7.95 |
| 5. Acceptance (M) | | | | | 0.58** | 0.22** | 4.40 | 0.65 |
| 6. Acceptance (F) | | | | | | 0.27** | 4.24 | 0.81 |
| 7. Family Income | | | | | | | 5.74 | 1.39 |

*Note.* (M) = Mothers; (F) = Fathers.
* $p < .05$. ** $p < .01$.

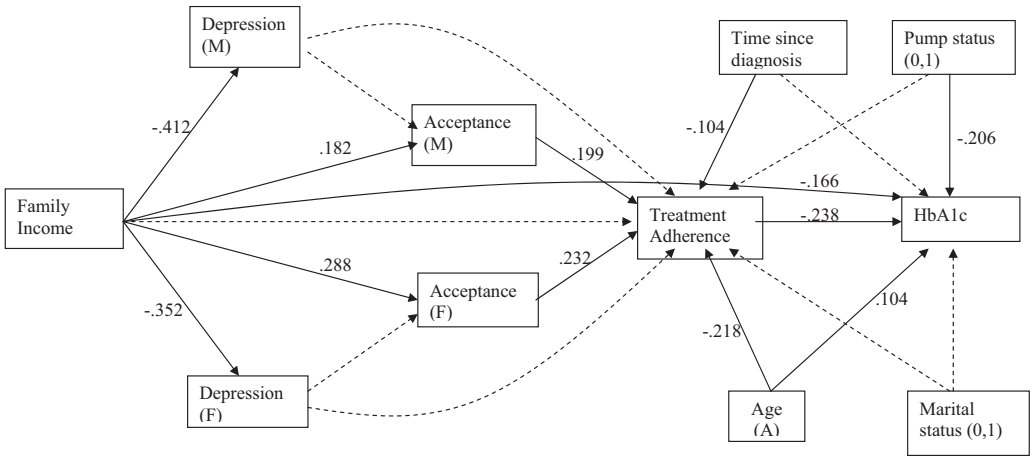


*Figure 1.* Results of a structural model depicting associations between family income and adolescent diabetes outcomes: Yuan$\chi^2$ Yuan-Bentler (27), $n = 252 = 43.786$, $p = .038$; CFI = .984; RMSEA = .029. Significant correlations and standardized path coefficients ($p < .05$) are presented as solid lines; nonsignificant parameters are presented as dashed lines. Note: Figure presented with standardized values. Model fit, correlations, indirect effects, $R^2$ values, and notes on 0,1 coding are below; (F) = Father; (M) = Mother; (A) = Adolescent. Model fit: $\chi^2$ Yuan-Bentler (27) = 43.786, $p = .038$; CFI = .984; RMSEA = .029.

tance of their adolescent, which is associated with lower adherence and poorer metabolic control.

## Discussion

The present findings demonstrate that lower income is associated with poorer HbA1c, even in a sample that was not selected for economic insecurity. In the current study, along the observed income gradient, lower income was associated with higher risk for depleted parental psychological resources (e.g., lower parental acceptance). These results advance the current literature by showing that families with lower income may undermine the quality of relationships that adolescents have with their mother and father. Lower family income was indirectly associated with poorer adherence and metabolic control. Adolescent perceptions of lower parental acceptance fully mediated lower family income associations with treatment adherence, and partially mediated its associations with metabolic control. These mediational pathways suggest lower parental acceptance may be one path toward poorer treatment adherence and metabolic control for families facing heightened economic strain.

Lower levels of family income may indirectly affect treatment adherence and metabolic control by creating a nonsupportive family environment. These results are consistent with Gallo and Matthew's (2003) resource model and with Conger et al.'s Family Stress Model in the developmental literature (Conger & Conger, 2002; Conger & Elder, 1994; Conger & Donnellan, 2007). Lower family income was not directly associated with treatment adherence as similarly found in previous diabetes and chronic health research (Davis et al., 2001; Diaz et al., 2000). We did not measure processes that may explain how income might impair adolescent–parent relationships, although the developmental literature (see Conger & Conger, 2002; Conger & Elder, 1994; Conger & Donnellan, 2007) consistently suggests a link between lower family income and various aspects of parenting (e.g., more control; nurturing and involved parenting, Conger & Donnellan, 2007; Hoffman, 2003). For parents of adolescents with Type 1 diabetes, we speculate that lower family income may create economic hardship that may deplete their resources to develop the types of relationships with their adolescent that are useful for maintaining treatment adherence and metabolic control during adolescence. Future research that examines these possibilities will be important for guiding clinical interventions.

In contrast to our hypothesis, parental depressive symptoms were not a mediator of the association between income and adherence or HbA1c. This was unexpected since the general literature has consistently observed that lower income parents experience more depressive symptoms and lower parental acceptance (Conger & Elder, 1994). Although an association has been observed in the diabetes literature between parental depression and acceptance, diabetes studies have not examined parental acceptance as a mediator of the income-to-HbA1c relationship; parental monitoring, however, has been found to be a significant mediator (Eckshtain et al., 2010). This inconsistency in findings may have occurred due to the fact that there was not a large enough range of parental depressive symptoms, as the levels in the current study were subclinical. However, previous research has demonstrated a link between parental depressive symptoms and a lack of positive parental behavior, even with subclinical levels of distress (Kane & Garber, 2004; Lovejoy, Graczyk, O'Hare, & Neuman, 2000). Alternatively, the lack of association may reflect that the current study measured adolescents' perceptions of parental accep-

tance, rather than the more typical focus on specific parental behaviors (i.e., monitoring). It is possible that parental depressive symptoms have a more limited impact on the adolescent's perceptions of parental acceptance than it might have on parental monitoring, because monitoring has a behavioral component and may be difficult to maintain in the context of a behaviorally demanding illness such as diabetes. A final factor to note is that the current study assessed adolescents' perception of parental acceptance and parental reports of depressive symptoms (i.e., two reporters, adolescent and parent), while the majority of previous research has assessed parental perception of parenting and depressive symptoms (Jaser & Grey, 2010).

The results should be interpreted in the context of some limitations. First, the cross-sectional nature of our data precludes us from making strong mediational conclusions. That is, although our results are consistent with a mediational model, the fact that our measures were all gathered at one point in time means that we do not have temporal precedence, an important component of any mediational model. Second, our results are limited to adolescents' reports of mothers' and fathers' acceptance. Previous work suggests that it is adolescents' perceptions of parent–child relationships that are most predictive of diabetes management outcomes, but self-report biases cannot be ruled out (Berg et al., 2008; Palmer et al., 2011). Third, our results are restricted to the metrics of self-reported family income as the lone indicator of SES. Family income was chosen as a measure of SES because it is observed to be an effective measure of income-related health disparities and is consistently associated with the large amount of the health disparities between low- and high-income individuals (Adler, 2009). Additionally, family income, like the other components of SES (i.e., education and occupation), places individuals in a social hierarchy as needed to understand the impact of high or low income on health outcomes (Adler, 2009). Finally, our results are restricted in generalizability as our sample of families included predominantly intact White, English-speaking, middle-class participants. It is notable, however, that we found income effects even with the limited variability that may result from this relatively homogeneous sample.

In the literature it is clear that adolescent health is influenced by family income and parental resources (Adler, 2009; Conger & Donnellan, 2007; Gallo & Matthews, 2003). Our findings add to this literature by demonstrating that along the income gradient from lower to higher family income, lower income is associated with higher (i.e., worse) HbA1c through lower levels of mother and father acceptance and treatment adherence. The mediation results are important to understanding the relationship of lower family income and HbA1c in Type 1 diabetes, and the association of the adolescent's perception of parental acceptance in adolescents' success in controlling their HbA1c. These findings suggest that clinical interventions with families along an income gradient would benefit from interventions targeted at supporting families with children with diabetes so that parents can understand the importance of good communication and parenting skills that provide an accepting environment. Such results are especially significant in recent times of economic downturn (such as the recession beginning in 2008), as such recessions affect nearly every part of the income gradient, likely affecting health outcomes of a large number of families. Unfortunately, in such times when families need support to buffer the economic hardships that may create challenges for their psychological resources, such services may be difficult to find.

Providing families with the supports that are needed such that parents can maintain resources so that adolescents feel accepted is likely to be associated with better diabetes health outcomes into adulthood. Family outreach intervention programs have proven effective in training parents in emotional communication skills (e.g., active listening, reduced negativism and criticism), which are essential to adolescents' feelings of parental acceptance (Saywitz et al., 2009). Achieving good metabolic control is crucial, as poor metabolic control during adolescence is strongly correlated with mortality and morbidity in adulthood (White et al., 2001). Helping families with lower income to understand the impact of parenting on diabetes outcomes will likely be beneficial to long-term diabetes management and adolescents' successful transition into adulthood.

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Received January 5, 2011
Revision received July 20, 2011
Accepted July 20, 2011 ■