Mothers', Fathers', and Children's Perceptions of Parental Diabetes Responsibility in Adolescence: Examining the Roles of Age, Pubertal Status, and Efficacy*

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Objectives To examine how perceptions of parental responsibility for diabetes management are associated with age, pubertal status, adolescents' self-efficacy, and parental perceptions of adolescents' efficacy, and if parental responsibility is associated with better metabolic control as a function of adolescents' self-efficacy and parental perceptions of adolescents' efficacy. **Methods** Questionnaires assessing parental responsibility, pubertal status, adolescents' self-efficacy, and parental perceptions of adolescents' efficacy were given to 185 adolescents with type 1 diabetes, 185 mothers, and 145 fathers. **Results** Greater parental responsibility was negatively associated with age, perceptions of pubertal status, and efficacy for all reporters. Interactions between parental responsibility and parental perceptions of adolescents' efficacy indicated that parental responsibility was associated with better metabolic control when adolescents were perceived to have lower efficacy. **Conclusions** Adolescents' and parents' perceptions of parental responsibility are related to multiple factors. Metabolic control is best when high parental responsibility is maintained among adolescents with lower efficacy.

Key words adolescents; age; diabetes; efficacy; fathers; mothers; puberty.

Adolescence is a particularly difficult period for type 1 diabetes management given the social, emotional, and physical changes that occur (Steinberg & Silk, 2002). Less optimal metabolic control and adherence to treatment guidelines, as well as severe noncompliance (La Greca, et al., 1995) happen during this time. A potential explanation for suboptimal disease regulation in adolescence may be a premature decline in parental responsibility (Anderson, Ho, Brackett, Finkelstein, & Laffel, 1997; Wysocki et al., 1996) that occurs as a function of age (Drotar & Ievers, 1994), rather than children's actual efficacy in successful diabetes management, diabetes knowledge (Holmes et al., 2006), or autonomy (Palmer et al., 2004). During adolescence, children and parents may adjust responsibility due to many developmental factors (age, pubertal status, and autonomy; Palmer et al., 2004). In the existing literature on parental responsibility for diabetes management, data come largely from mothers' and/or adolescents' perceptions (Anderson, Auslander, Jung, Miller, & Santiago, 1990; Wiebe et al., 2005) and rarely from fathers (Laffel et al., 2003). Because mothers and fathers may view responsibility in disparate ways and respond differently to various maturity markers, understanding these potential differences may be important both theoretically and clinically (Steinberg, 1987). A primary goal of the study was to examine adolescents', mothers', and fathers' perceptions of parental responsibility for diabetes management and determine whether these were associated differentially with both broad developmental markers (i.e., age and pubertal status), and more

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specific perceptions of adolescents' diabetes management efficacy (adolescents' self-efficacy and parental perceptions of adolescents' efficacy).

Information regarding how parental diabetes responsibility for management is transferred from parent to child has focused nearly exclusively on mothers, as they are still the primary caregivers for children with diabetes (Seiffge-Krenke, 2002) and other pediatric conditions (Quittner, DiGirolamo, Michel, & Eigen, 1992). However, fathers play a crucial role in adolescence in general (Bumpus, Crouter, & McHale, 2006) and their support (Wysocki & Gavin, 2006) and monitoring (Berg et al., 2008) may be associated with better diabetes management, despite their relatively less active role in daily management compared to mothers (Seiffge-Krenke, 2002). We do not know whether fathers' perceptions of the variables responsible for transferring responsibility from parent to child are similar to the perceptions of adolescents or mothers. Thus, an important contribution of this study was to compare fathers to mothers and adolescents in terms of the variables that are related to decreases in parental diabetes responsibility.

The motivations for and process of transferring diabetes responsibility from parent to child are complicated and multifaceted. Attempts to disentangle the roles that age, pubertal maturation, and efficacy play (Anderson & Coyne, 1991) suggest mothers' diabetes responsibility decreases with increasing adolescent age (Palmer et al., 2004), concurrently with children gaining responsibility and influence in family decision-making during adolescence (Cooper, Grotevant, & Condon, 1983). In addition, the transfer of diabetes responsibility from mother to child is related to mothers' perceptions of the outward signs of puberty (Holmes et al., 2006). Pubertal maturation in itself is a challenge to optimal diabetes regulation due to dysregulating hormonal changes (Seiffge-Krenke, 1998, 2001) and changes in parent–adolescent relationships (Laursen, Coy, & Collins, 1998). The use of age or pubertal status as a primary signal for the transfer of responsibility from parent to child may be problematic if the adolescent does not have the requisite competence to successfully manage his or her illness (Holmes et al., 2006; Palmer et al., 2004).

Parental responsibility may also be transferred as a function of the adolescents' efficacy in conducting diabetes management tasks (Holmes et al., 2006). Adolescents' self-efficacy regarding diabetes management has been defined as their belief or confidence in their ability to carry out tasks involved in diabetes management (Iannotti et al., 2006). Self-efficacy beliefs have been linked to enhanced adherence to chronic disease management regimens (Clark et al., 1988) and more optimal metabolic control (Grossman, Brinks, & Hauser, 1987). Thus, high adolescent self-efficacy and/or parental perceptions of adolescents' efficacy may signal to parents that they can safely decrease their level of responsibility. Ott, Greening, Parlardy, Holderby, and DeBell (2000) advocated that children's efficacy be used to determine when parents should transfer increasingly complicated tasks to the child.

Despite declines across adolescence in parental responsibility with increased age, parental responsibility is critical for successful diabetes management, given the treatment demands for efficient decision-making, complicated mental and physical skills, frequent planning, and dedication to a daily regimen (Anderson et al., 1997). By the age of 13, many children are able to participate in most diabetes tasks (Wysocki et al., 1996), though parental responsibility is still needed as poorer metabolic control and more frequent hospitalizations are associated with declines in parental responsibility (Anderson et al., 1997). A more optimal transfer of responsibility may occur if parents gradually cede diabetes tasks in response to the adolescent's success in diabetes management (Holmes et al., 2006), rather than doing so more abruptly, merely as a function of reaching an implicit age or physical maturation level. Our previous work (Palmer et al., 2004) indicated that poorer metabolic control (higher HbA_{1c} values) was predicted through the interactions of: (a) maternal diabetes responsibility and adolescents' autonomy when maternal diabetes responsibility and adolescent autonomy were both low and (b) maternal diabetes responsibility and adolescents' pubertal status were both low. However, this prior work was inconclusive regarding whether metabolic control was clearly predicted by the interaction of parental responsibility and autonomy or parental responsibility and pubertal status, as our measure of autonomy was based only on adolescent report and pubertal status only on mother report. Currently, we gathered self-efficacy from adolescents and perceptions of adolescents' efficacy from parents to further our understanding of how these connect to perceptions of parental responsibility.

A primary goal of the study was to identify how age, pubertal status, adolescents' self-efficacy, and parental perceptions of adolescents' efficacy were associated with and predicted the transfer of responsibility for diabetes management from parents to adolescents, from multiple perspectives. We extended our prior work (Palmer et al., 2004) on maternal reports of pubertal status to also include paternal and adolescent reports, and added adolescents' self-efficacy and parental perceptions of

adolescents' efficacy. We predicted that age would relate to diabetes responsibility, but that parents especially may respond to other markers such as pubertal status and their perceptions of adolescents' efficacy. We examined whether parental responsibility was associated with better metabolic control as a function of adolescents' self-efficacy and parental perceptions of adolescents' efficacy, predicting that better metabolic control would occur when levels of parental responsibility were responsive to the perceived efficacy of the adolescent.

Method

Participants

The study was approved by the University of Utah's Institutional Review Board. Parents gave written informed consent and adolescents gave written assent. Participants included 185 adolescents (M age = 12.52 years, SD = 1.53; 53% females) diagnosed with type 1 diabetes mellitus, their mothers (M age = 39.97, SD = 6.32) and 145 fathers (M age = 42.26, SD = 6.20) recruited from a university/private partnership clinic (87.6%) and a community-based private practice (12.4%), that followed similar treatment regimens and clinic procedures. Eligibility criteria included that adolescents were between 10 and 14 years of age, had diabetes for >1 year (M = 4.78 years, SD = 3.0), and were able to read and write either English or Spanish. For each adolescent, one mother and one father were eligible to participate. Adolescents were required to be living with their participating mother because a major goal of the larger project is to model changes in mother–child relationships over time. Step-mothers or adopted mothers (3.8%) were eligible if they had lived with the adolescents for at least 1 year. To ensure that fathers' involvement in diabetes management was represented, fathers of participating children were actively recruited, with most agreeing to participate (78%). If both a biological father and a step-father or adoptive father were eligible for participation, we recruited the father that adolescents reported was most involved in their diabetes management. Most participating fathers were biological, with the remainder being step-fathers or adoptive fathers (11.4%).

Approximately half (49.7%) of adolescents were on an insulin pump, with the remainder prescribed multiple daily injections (MDI). Mothers of adolescents on MDI reported physicians recommended an average of 4.2 insulin injections (SD = 1.4, range: 2–8) and 5.0 blood glucose checks per day (SD = 1.4, range: 1–10).

Of the qualifying individuals approached, 66% agreed to participate in the study, the first wave of a 3-year longitudinal study (reasons for refusal included commute distance 23%, too busy 21%, not interested 30%, uncomfortable with being studied 16%, time commitment 6%, other illness in family 5%, and no reason 3%). Comparisons of eligible adolescents who did versus did not participate indicated participants were older [12.5 vs. 11.6, $t(367) = -6.2$, $p < .01$], but did not differ on gender, pump status, HbA_{1c}, or time since diagnosis (p's > .05). Families were largely Caucasian (94%) and middle class: most (73%) reported household incomes averaging $50,000 or more annually, 51% of mothers and 58% of fathers reported education levels of 2 years of college or beyond, and an average Hollingshead index (1975) value of 42.04 indicating a medium business, minor professional, technical status.

Procedure

Participants completed appointments at the University of Utah as a part of a larger protocol (Berg et al., 2008) within 11.5 days (on average) of recruitment. Medical records were accessed to obtain HbA_{1c} values. All participants received $50 compensation.

Measures

The descriptive statistics for all measures used in this current study may be found in Table I.

Behavioral Involvement in Diabetes Management Tasks

The responsibility items of the Diabetes Responsibility and Conflict Scale (Rubin, Young-Hyman, & Peyrot, 1989) were completed independently by each participant to assess perceptions of who is responsible for completing 23 aspects of diabetes management (e.g., ''Who determines the insulin dose?''). For each item, participants used a five-point Likert-type scale (e.g., for adolescents the choices ranged from 1 = I do it alone to 3 = I share equally with my parents to 5 = My parent does it alone). Corresponding responses were available to parents (e.g., 1 = My child does it alone to 5 = Parent does it alone). Adolescents on diabetes pumps completed five additional items unique to their diabetes management (e.g., ''Who changes pump batteries?''). These items were created through consultation with a diabetes educator and a person with diabetes to be relevant to intensive management and pump regimens. Average scores, which included all items (nonpump and pump, where applicable) were computed for analyses. For this measure, 1.0 was the minimum and 5.0 was the maximum possible average value. Higher scores indicate greater parental responsibility for diabetes management; lower scores indicate lesser parental responsibility for diabetes management. This scale is

Table I. Relevant Study Variables: Intercorrelational and Descriptive Statistics

	1	2	3	4	5	6	7	8	9	10	11	12	13	Mean	SD	Range
1) A Responsibility		.73**	.65**	−.51**	−.45**	−.46**	−.39**	−.21*	−.38**	−.20*	.08	.14	−.04	2.56	0.57	1.18–4.26
2) M Responsibility			.76**	−.56**	−.55**	−.60**	−.53**	−.19*	−.47**	−.35**	.13	.21*	−.15	2.88	0.58	1.50–4.43
3) F Responsibility				−.57**	−.50**	−.55**	−.50**	−.23**	−.37**	−.37**	.04	.27**	−.12	2.98	0.61	1.61–4.48
4) Age					.61**	.64**	.59**	.13	.10	.13	.13	.06	−.06	12.48	1.48	10.0–14.92
5) A Puberty						.88**	.82**	.07	.11	.11	.04	−.14	.25**	2.30	0.77	1.00–4.00
6) M Puberty							.89**	.12	.17*	.15	.05	−.14	.34**	2.23	0.78	1.00–4.00
7) F Puberty								.14	.12	.13	.14	−.12	.28**	2.16	0.72	1.00–4.00
8) A Self-Efficacy									.30**	.43**	−.21*	.05	.02	6.54	1.65	2.20–9.80
9) M Efficacy										.43**	−.31**	−.12	.00	5.74	1.76	1.30–9.40
10) F Efficacy											−.29**	−.14	.08	5.87	1.81	1.30–10.0
11) HbA_{1c}												.09	.03	8.06	1.32	4.90–13.90
12) Length since diabetes diagnosis^													−.00	55.50	35.51	12.0–144.0
13) Gender#																

A, adolescent; M, mother; F, father, ^ = months; # = 1 for males and 2 for females.
*$p < 0.05$; **$p < 0.01$.

sensitive to the declines in maternal involvement that occur during adolescence (Rubin et al., 1989), and has previously shown high concordance between mother and child, $r = .75$, $p < .001$ and good reliability (α's $> .79$; Palmer et al., 2004). Intercorrelations among participants' reports (r's $> .65$, p's $< .01$) and internal consistency (α's $> .91$) were high in the current study.

Puberty

Pubertal status was measured via participants' reports of the extent to which the adolescent displayed signs of puberty (Petersen, Crockett, Richards, & Boxer, 1988). Three general items applied to all adolescents (height, body hair, and skin changes), two items applied to males (voice deepening and facial hair growth) and two items applied to females (breast growth and had menstruation begun). Items were completed on a four-point Likert-type scale (1 = has not yet started to 4 = seems completed). Consistent with Petersen et al.'s (1988) procedures, the menstrual question for females was scored ''4'' if the menstrual period had begun and ''1'' if it had not yet begun. An average score was calculated for this measure. The minimum average value was 1.0 and the maximum average value was 4.0. The scale has previously been shown to have adequate internal reliability (Miller, Tucker, Pasch, & Eccles, 1988); this was also true for the current sample (adolescents' $\alpha = .80$, mothers' $\alpha = .83$, fathers' $\alpha = .79$).

Perceived Efficacy for Diabetes Management

The Self-Efficacy for Diabetes Management Scale (Iannotti et al., 2006) was included to assess adolescents' perceptions of their ability to manage diabetes across problematic situations. Adolescents responded to the question ''How sure are you that you can do each of the following, almost all the time'' for 10 items, such as: ''adjust your insulin correctly when you eat more or less than usual'' using a 10-point Likert-type scale (1 = not at all sure to 10 = completely sure). Parents completed an adapted version to index their own perceptions of adolescents' efficacy (e.g., ''How sure are you that your child can do each of the following, almost all the time'') using the same 10-point Likert-type scale. An average score was calculated for this measure, with higher values indicating greater perceptions of efficacy. Prior work (Iannotti et al., 2006) that examined adolescents with type 1 diabetes showed this scale to be both valid and reliable ($\alpha = .90$). Reliability in the present study was also good (adolescents' $\alpha = .81$; mothers' $\alpha = .87$; fathers' $\alpha = .90$).

Metabolic Control

Adolescents' glycosylated hemoglobin (HbA_{1c}) levels were obtained from medical records at the time of recruitment. HbA_{1c} provides information on average blood glucose levels over the preceding 3 or 4 months, and is the standard index as to whether diabetes treatment goals are being achieved (higher levels indicate poorer metabolic control).

Results

Preliminary Analyses

Variables were checked for missing, out-of-range values, univariate and multivariate outliers, as well as normalcy. A mean replacement strategy was utilized when <25% of the data for a particular measure was missing. Although many cases displayed instances of univariate outliers, none emerged as a multivariate outlier. No variable

demonstrated significant departures from normalcy in terms of skew, though HbA_{1c} showed significant kurtosis. However, no transformation of this variable was performed in order to preserve meaningful interpretation (Tabachnick & Fidell, 2001). Therefore, all analyses included the raw variables.

Because the analyses comparing respondents required complete families, the analyses reported below are based on the 145 families where a father participated. As can be seen in Table I, increasing age and higher perceived pubertal status and adolescents' self-efficacy and parental perceptions of adolescents' efficacy were all associated with perceptions of lower parental diabetes responsibility for all reporters. Both age and pubertal status were unrelated to adolescents' self-efficacy and parental perceptions of adolescents' efficacy (with the exception of mothers' reported pubertal status and her perceptions of adolescents' efficacy). Participants largely reported mid-levels of diabetes responsibility (i.e., parents viewed adolescent and parent sharing most tasks, the adolescent viewed they were doing slightly more tasks independently). The adolescents were slightly past the mid-point of pubertal maturation, and reported moderate levels of self-efficacy. Parental perceptions of adolescents' efficacy were also estimated to be at moderate levels, with only modest correlations among adolescents' perceptions of self-efficacy and parental perceptions of adolescents' efficacy. Because pubertal status involved different markers for males and females, all effects in all analyses reported throughout the paper were examined as to whether they were moderated by gender. No statistically significant interactions with gender occurred either for the comparisons of effects across reporters or for the moderation analyses.

All subsequent analyses were conducted with length since diabetes diagnosis (in months) and adolescent gender serving as covariates, as evidence suggests that length of diabetes diagnosis is connected with diabetes management (Wiebe et al., 2005) and that gender differentially predicts diabetes adherence (Korbel, Wiebe, Berg, & Palmer, 2007; Naar-King et al., 2005).

Age, Pubertal Status, Adolescents' Self-efficacy, and Parental Perceptions of Adolescents' Efficacy as Predictors of Parental Diabetes Responsibility

Because adolescents, mothers, and fathers were nested within a family unit, we used Hierarchical Multivariate Linear Modeling (HMLM2, Raudenbush, Brennan, & Barnett, 1995). This procedure accounts for the dependencies across reporters. This procedure simultaneously estimated models for adolescents, mothers, and fathers to discern, which variables uniquely predicted parental responsibility within reporter, and allowed us to test for differences in regression weights across reporters (Berg et al., 2007). Each regression thus included each reporter's perception of parental responsibility as the dependent variable, and mean length since diagnosis (in months) and gender as covariates, and age, perception of pubertal status, adolescents' self-efficacy, and parental perceptions of adolescents' efficacy as independent variables (Table II).

Table II. Age, Pubertal Status, and Diabetes Efficacy Predicting Diabetes Responsibility

	Adolescent Report		Mother Report		Father Report	
	β	*SE*	β	*SE*	β	*SE*
Length of Diagnosis	.002*	.001	.003**	.001	.005**	.001
Gender	−.046	.084	−.120	.073	−.116	.078
Adolescent Age	−.162**	.034	−.156**	.030	−.204**	.031
Puberty	−.099	.063	−.168**	.058	−.102	.063
Efficacy	−.032	.020	−.074**	.015	−.064**	.018

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

For the analysis of adolescents' perceptions of parental responsibility, as can be seen in the first section of Table II, only age predicted diabetes responsibility indicating that older adolescents reported less parental responsibility than younger adolescents. For mothers' report of parental responsibility, higher age, pubertal status, and mothers' perceptions of adolescents' efficacy were each uniquely associated with lower responsibility (second column of Table II). For the analysis of fathers' perceptions of parental responsibility, higher age, and fathers' perceptions of adolescents' efficacy were associated with lower parental responsibility (third column of Table II).

Because these analyses suggested that different reporters may respond differently to pubertal status, adolescents' self-efficacy, and parental perceptions of adolescents' efficacy, we directly compared whether these effects differed across reporters. A test of whether reporters differed on the slope coefficient relating pubertal status to parental responsibility revealed no statistically significant differences between adolescents and mothers [$\chi^2(1) = 1.01$, $p > .30$], or mothers and fathers [$\chi^2(1) = .91$, $p > .50$]. Because these tests were not statistically significant, we conducted a pooled test of the coefficient across adolescents, mothers, and fathers, which was statistically significant [$\chi^2(1) = 7.34$, $p < .01$]. Thus, across reporters higher pubertal status was associated with lower parental responsibility. A similar set of analyses was conducted for reports of adolescents' self-efficacy and parental perceptions of adolescents' efficacy across reporters. A test of whether reporters differed on the

slope coefficient relating efficacy to parental responsibility revealed a marginally statistically significant effect comparing adolescents and mothers [$\chi^2(1) = 3.2$, $p = .07$], but no statistically significant differences between adolescents and fathers [$\chi^2(1) = 1.7$, $p > .15$]. A pooled test of the coefficient across reporters indicated that adolescents' self-efficacy and parental perceptions of adolescents' efficacy were significantly associated with parental responsibility [$\chi^2(1) = 24.3$, $p < .01$].

The Interaction Between Parental Responsibility and Adolescents' Self-efficacy and Parental Perceptions of Adolescents' Efficacy in Predicting HbA_{1c}

To understand whether parental responsibility was associated with better metabolic control as a function of adolescents' self-efficacy and parental perceptions of adolescents' efficacy, a series of moderation analyses were conducted with HbA_{1c} serving as the dependent variable through multiple regression. Three separate regressions were conducted because HMLM does not allow the dependent variable to be the same across reporters. In the first step of each analysis, the covariates, adolescents' reports of parental responsibility, and either the adolescents' self-efficacy or parental perceptions of adolescents' efficacy scores (centered on their means) were entered. In the second step, the interaction between parental responsibility and adolescents' self-efficacy or parental perceptions of adolescents' efficacy was entered. We present next information on the interaction terms as these represent the analyses of interest.

The interaction was not statistically significant, $t(145) = 1.01$, $p > .30$, $\beta = .08$ for adolescent reports of parental responsibility and self-efficacy.[1] However, the interaction was statistically significant for both mothers', $t(145) = 2.92$, $p = .00$, $\beta = .27$, and fathers' reports, $t(143) = 2.14$, $p < .05$, $\beta = .18$. Predicted values were computed from the regression equations by substituting scores 1 *SD* above and below the mean for parental responsibility and parental perceptions of adolescents' efficacy (Figs 1 and 2). The interactions revealed that greater parental responsibility was associated with better (lower) HbA_{1c} primarily when adolescents were perceived by their parents as having lower efficacy. Thus, metabolic control was better when higher parental responsibility from the mother and father reports occurred in the context of lower perceptions of adolescent efficacy.

[1]The results of the moderation analyses examining the interactions for adolescents' reports run with the full N=185 sample indicated that this interaction was significant. Mothers' and fathers' reports run with the full $N = 185$ sample were consistent with the findings currently presented using the $N = 145$ sample.

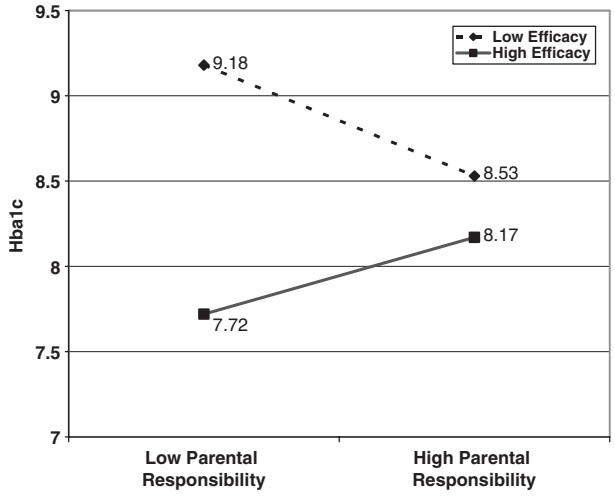

Figure 1. Mothers' reports of parental responsibility by mothers' reports of adolescents' efficacy predicting HbA_{1c}.

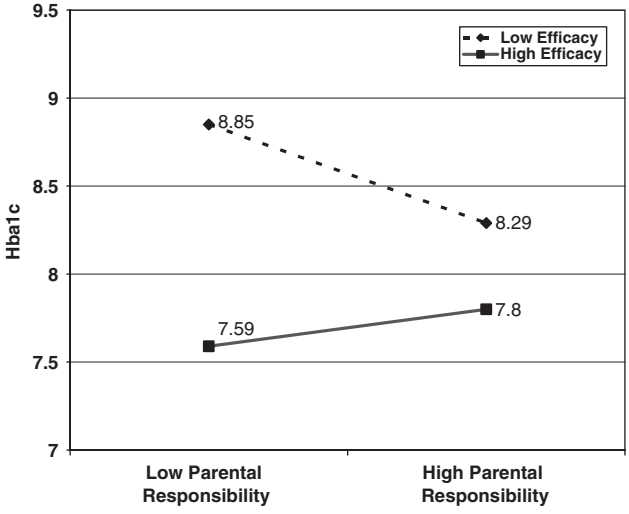

Figure 2. Fathers' reports of parental responsibility by fathers' perceptions of adolescents' efficacy predicting HbA_{1c}.

Discussion

Age, Pubertal Status, Adolescents' Self-efficacy, and Parental Perceptions of Adolescents' Efficacy in Understanding Parental Diabetes Responsibility

As expected, age was associated with adolescent, maternal, and paternal reports of parental diabetes responsibility. The importance of age for predicting behavior has been supported in previous research on developmental expectations or implicit theories of development

(Dekovic, Noom, & Meeus, 1997). For parents and children, age is an important predictor of when specific developmental tasks and behaviors ''should'' be performed by children, even when considering other factors such as culture (Feldman & Quatman, 1988), gender, pubertal timing, and temperament (Dekovic et al., 1997).

Adolescents' and parents' views of parental diabetes responsibility, however, were sensitive to multiple variables, consistent with prior investigations (Holmes et al., 2006; Palmer et al., 2004). Although only mothers' perceptions were significantly related to pubertal status (Steinberg, 1987), comparisons among reporters revealed no differences and the pooled effect was statistically significant. Thus, our results suggest that in addition to age, adolescents, mothers, and fathers respond to adolescents' physical maturation when thinking about parental responsibility for diabetes management. In addition, mothers' and fathers' perceptions of adolescents' efficacy were related to diabetes responsibility levels in similar ways, with adolescents' self-efficacy being less related to responsibility. Thus, mothers and fathers appeared to utilize not just age when considering their responsibility (note that age was an imperfect marker of developmental maturity as no significant correlations were found between age and adolescents' self-efficacy or parental perceptions of adolescents' efficacy). Parents also used an additional marker that is more reflective of how competent the child is perceived to be. The fact that both mothers and fathers utilized their perceptions of adolescent efficacy in a similar manner is informative, as fathers have been described as much less involved (Berg et al., 2008; Seiffge-Krenke, 2002) than are mothers, yet still important for better diabetes management (Wysocki & Gavin, 2006). Despite these previously reported patterns, fathers and mothers appeared in the present work to consider how they, together with their adolescents, should be responsible for diabetes tasks, in a more complicated, multifaceted manner than simply relying upon a single variable. Future work is ongoing in our laboratory to understand whether these patterns uncovered for mothers' and fathers' reports of how parents as a unit were involved to generalize mothers' and fathers' perceptions of their own diabetes responsibility.

The fact that adolescents' self-efficacy perceptions were marginally less related to parental responsibility than were mothers' perceptions of adolescents' efficacy could be due to differences between adolescents and parents in their views of adolescents' efficacy. The modest intercorrelations among adolescents' self-efficacy, and mothers' and fathers' perceptions of adolescents' efficacy indicated differences in perceptions. Adolescents may report higher levels of self-efficacy or diabetes responsibility, in order to promote a more independent or responsible image during adolescence (Dekovic et al., 1997; Feldman & Quatman, 1988). In addition, adolescents and their parents may utilize different criteria for evaluating success or failure and perceptions of responsibility. Determining which respondent is more accurate may be important, though subjective perceptions may differ from objective assessments earlier in adolescence (Dubas, Graber, & Petersen, 1991). Subjective perceptions may be more influential for adolescents' perceptions of abilities than more objective indicators. For instance, in education adolescents' perceptions have been shown to be more closely aligned with parental beliefs than with measures such as grades (Parsons, Kaczala, & Meece, 1982).

The Interaction Between Parental Responsibility and Adolescents' Self-efficacy and Parental Perceptions of Adolescents' Efficacy in Predicting HbA_{1c}

The importance of parental perceptions of adolescents' efficacy for adjustments in parental responsibility during adolescence was also observed in the moderation analyses. Our analyses suggest that lower parental diabetes responsibility is only associated with poorer (i.e., higher) HbA_{1c} when adolescents were viewed by parents as having low efficacy. These results suggest that metabolic control was better when parental responsibility was matched to parental perceptions of adolescents' efficacy in managing diabetes tasks. Although these results were not significant for adolescents' perceptions of their self-efficacy, the interaction was present for adolescents when considering the full sample of 185 adolescents and not restricting the sample to the 145 adolescents whose fathers participated. The significant interaction for mothers and fathers is consistent with prior concerns voiced regarding the premature transfer of diabetes responsibility from parent to adolescent (Palmer et al., 2004; Pattison, Moledina, & Barrett, 2006). Our work, however, adds to this literature by further highlighting the importance of variables that parents can use in the transfer of diabetes responsibility from parents to adolescents in a way that maximizes diabetes outcomes. Clinically, the implications of our findings are that parents and adolescents could be taught to use their views of adolescents' efficacy as a guide as to when to transfer responsibility from parent to adolescent. Additionally, clinicians and parents and adolescents may need to openly discuss the possibility that disparate views of adolescents' efficacy for diabetes management may very well exist, due to normative developmental processes

occurring at this time of life. Our findings indicate that substituting parental perceptions of adolescents' efficacy as a marker, as opposed to age alone, may potentially assist families in the difficult task of managing diabetes. Subsequent investigations are needed to try to determine what is occurring in families when such a mismatch of parental perceptions of adolescents' efficacy and parental responsibility exists.

The study must be interpreted in the context of some limitations. First, it relied heavily on self-reported paper and pencil measures of diabetes responsibility, subjective pubertal status, and efficacy for diabetes management. However, an important strength of the present investigation is that it utilized multiple family members' reports of all the measures of interest. Future work may benefit from the use of different response modalities, such as interviews (Anderson, Ho, Brackett, & Laffel, 1999), and should be supplemented with more behaviorally oriented measures of parents' diabetes responsibilities, such as the 24 hr reporting of adherence (Anderson, Brackett, Ho, & Laffel, 2000). Second, the cross-sectional nature of our research precludes us from examining the changes with age that we suggest occur in the transfer of diabetes responsibility; ongoing longitudinal work with this sample will address these issues across time. The cross-sectional nature of our study's design also precludes us from drawing causal connections between the variables of interest. Third, the HbA_{1c} values were collected at the time of recruitment into the study and thus give us only a snapshot of how diabetes responsibility and adolescents' self-efficacy and parental perceptions of adolescents' efficacy relate to metabolic control. It is possible that knowledge of HbA1c influenced family members' perceptions of responsibility and adolescent self-efficacy. Fourth, the lack of ethnic diversity, and the relatively high educational and economic status of our participants, hinders the generalizability of our findings. Fifth, participants were recruited during a routine checkup, thereby excluding individuals who are not treated by medical personnel on a regular basis.

The study indicated that although age is clearly an important developmental marker for all family members, adolescents and parents additionally consider their perceptions of pubertal status and adolescents' efficacy in diabetes management. Our results indicate that traditional markers of developmental maturity such as age are inadequate markers of the efficacy of the adolescent. This research suggests the importance of matching diabetes responsibility to the adolescent's self-efficacy and parental perceptions of adolescents' efficacy, in order to optimize metabolic control. Given the potential negative health consequences associated with diabetes mismanagement during adolescence, and evidence that patterns of mismanagement created in adolescence carry into adulthood, the necessity of managing this transition effectively is great.

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