

The Role of Autonomy and Pubertal Status in Understanding Age Differences in Maternal Involvement in Diabetes Responsibility across Adolescence

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Objective To examine how autonomy and pubertal status explain age decreases in maternal involvement in type 1 diabetes management across adolescence, how they relate to metabolic control, and the reasons that guide declines in maternal involvement. **Methods** One hundred twenty-seven children ages 10–15 years with type 1 diabetes and their mothers participated. Data included maternal and child report of diabetes management, child report of autonomy level, maternal report of pubertal status, maternal reports of reasons for transfer of diabetes responsibility, and glycosylated hemoglobin (HbA_{1c}) values. **Results** Autonomy and pubertal status partially mediated age effects on reports of maternal involvement. Mothers' reasons for transferring responsibility included responding to the child's competence, promoting competence and maturity in their child, and minimizing hassles and conflict. The transfer of diabetes responsibility from mother to child without sufficient autonomy and when pubertal status was low was related to higher HbA_{1c} values. **Conclusions** The importance of chronological age for changes in maternal involvement suggests the need to examine mothers' and adolescents' developmental expectations for diabetes management. The reasons for transferring responsibility from mother to child suggest many avenues for intervention.

Key words adolescents; mothers; diabetes; age; autonomy; pubertal status.

Adolescence is a challenging time for type 1 diabetes management. Adolescence is associated with deteriorating metabolic control and poorer adherence, with cases of severe noncompliance often emerging during mid-adolescence (Allen, 1983; Johnson, 1995; La Greca, 1988; La Greca, Auslander et al., 1995). Difficulties in managing diabetes during this developmental period may arise as parents decrease their involvement in daily diabetes care (Anderson, Auslander, Jung, Miller, & Santiago, 1990; Anderson, Ho, Brackett, Finkelstein, & Laffel, 1997; Wysocki et al., 1996), often prematurely. Declines in parental involvement may occur as parents make adjustments to the child's developing autonomy,

with signs of pubertal status signaling these changes in the child-parent relationship (Steinberg, 1987). Surprisingly little research has examined the specific developmental factors that may contribute to our understanding of parental involvement in diabetes management (Holmbeck, 2002). We examined the developmental factors involved in maternal involvement by measuring specific developmental markers in the child (autonomy and pubertal status) and by asking mothers what they focused on in the transfer of diabetes responsibility.

Parental involvement in type 1 diabetes management is critical, as management requires efficient decision making, complicated physical and mental skills, frequent

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planning, and dedication to a daily regimen (DCCT, 1994). Failure to adequately control blood glucose levels leads to serious consequences (DCCT, 1994). As type 1 diabetes onset occurs primarily in childhood and adolescence, parents of children with this disorder are required to assume a great deal of responsibility for providing treatment (Davis et al., 2001). Parents decrease their performance of diabetes management tasks with age (Allen, 1983; La Greca, 1988; Rubin, Young-Hyman, & Peyrot, 1989), consistent with the general developmental trend for parents to delegate increasing levels of responsibility to their children during early adolescence across numerous tasks (Cooper, Grotevant, & Condon, 1983). Clinical observations and empirical research suggest that children are able to participate in most diabetes tasks by age 13 (Anderson et al., 1990; La Greca, 1988; Wysocki et al., 1996). Decline in parental involvement in diabetes-specific tasks is associated with increased hospital admittances and poorer metabolic control (Anderson et al., 1997; La Greca, Auslander, et al., 1995; La Greca, Swales, Klemp, Madigan, & Skyler, 1995; Wysocki et al., 1992, 1996). Interventions that maintain parental involvement minimize such deterioration (Anderson, Ho, Brackett, & Laffel, 1999). Thus, across adolescence parents decrease their level of involvement in diabetes management, transferring more responsibility to the child; however, this transfer is often associated with poorer diabetes outcomes.

Explanations for the decline in parental involvement in diabetes management during adolescence typically center on the increasing autonomy needs of the child (Anderson & Coyne, 1991; McConnell, Harper, Campbell, & Nelson, 2001), although little research to date has explicitly examined this notion. Autonomy development entails global changes in the parent-child relationship that result in the child gaining increasing amounts of control over emotional, behavioral, and psychological aspects of life (Barber, 2002; Greenberger, Josselson, Knerr, & Knerr, 1974; Greenberger, 1984). The optimal end result is an adolescent who is self-reliant and maintains emotional bonds and connections to parents (Steinberg, 1987; Steinberg & Silverberg, 1986). Adjustments occur in both parenting behaviors and expectations such that children are given greater freedom and range in personal decision making (Barber, 2002; Steinberg & Silverberg, 1986). This process of autonomy development often involves the child spending much less time with parents (Larson & Richards, 1991), with parents having fewer opportunities to be involved in diabetes management-related tasks. Johnson (1995)

estimated that on average only 50% of adolescents' diabetes-related activities are conducted and observed in the presence of parents.

A primary goal of this study was to identify factors that determine the transfer of diabetes responsibility from mother to child. First, we used mediational analyses to determine whether developmental processes (e.g., autonomy and pubertal status) could explain the age differences in maternal involvement in diabetes management typically reported in the literature. A more optimal transfer of responsibility may occur if parents gradually transfer diabetes tasks to the child in response to the child's success in diabetes management and autonomy levels, with the parent maintaining a monitoring or coaching role (Anderson et al., 1999). Therefore, we hypothesized that adolescent autonomy would mediate the effects of age on maternal involvement in diabetes responsibility.

A less optimal process of transfer may occur if parents adjust their level of involvement in response to outward signs of maturity, such as pubertal status. Pubertal status (Simmons & Blyth, 1987; Steinberg, 1988) may serve as a salient marker to parents to reduce their level of involvement in children's diabetes management. As pubertal development entails adultlike secondary physical characteristics, parents may believe that with these characteristics come adultlike cognitive abilities and social maturity (Brooks-Gunn & Reiter, 1990). If pubertal status is used as a marker to transfer responsibility without the requisite competence at diabetes tasks and maturity level, poor levels of adherence and metabolic control may result. Puberty poses a particular threat to those with diabetes, due in part to hormonal changes (McConnell et al., 2001) as well as the cumulative and simultaneous effects of emotional, social, and physical changes occurring in children's lives (Seiffge-Krenke, 1998, 2001). Thus, a second mediational model was used to explore whether pubertal status could account for the age differences in maternal involvement.

A second and more exploratory approach to identifying factors leading to the transfer of diabetes responsibility from mother to child was to ask mothers to consider factors important for indicating that it is time to transfer responsibility to their child. The parental task of transferring responsibility is extremely complex and difficult (Seiffge-Krenke, 2001), with parents typically erring by transferring responsibility prematurely (Weissberg-Benchell et al., 1995; Wysocki et al., 1996). The premature transfer of responsibility for diabetes

management occurs perhaps a full year sooner than physicians believe is appropriate (Wysocki et al., 1996) and may occur as parents underestimate the frequency of mistakes made by their children in diabetes tasks (Weissberg-Benchell et al., 1995). This premature transfer of responsibility may occur as parents deal with the stressors and hassles of managing the illness (Berg et al., 2003; Seiffge-Krenke, 1998), respond to external pressures about what adolescents “should” do, and try to promote responsibility in the child. Understanding the factors that mothers perceive as involved in their efforts to transfer diabetes responsibility may provide information (supplemental to the mediational analyses) useful in understanding the process involved in mothers’ decline in involvement with age.

We also explored the implications of low maternal involvement on metabolic factors occurring concurrently with the developmental ones (i.e., puberty and autonomy). We hypothesized that transfer of diabetes responsibility from mother to child without the requisite levels of autonomy would be associated with poorer glycosylated hemoglobin (HbA_{1c}) levels.

Methods

Participants

Participants included 127 children (52% male, 48% female) 10–15 years of age ($M = 12.85$, $SD = 1.71$) with diagnoses of type 1 diabetes for at least one year ($M = 4.55$, $SD = 2.87$) and their mothers (M age = 40.9 years, $SD = 5.87$). A deliberate attempt was made to recruit individuals from early to middle adolescence to observe the key period of autonomy development (Steinberg & Silverberg, 1986). Mothers were recruited because they are the primary caregiver of children and are more frequently involved in the care and management of their child’s illnesses (Ehrenberg, Gearing-Small, Hunter, & Small, 2001). The majority (69.5%) of participants were recruited from the Diabetes Outpatient Clinic at Primary Children’s Medical Center (an additional 21.9% were obtained via a recruitment letter and 8.6% from summer diabetes camps). Sixty-eight percent of the patients who initially agreed to participate in the study actually completed the study. Independent t tests of those who completed the study versus those who did not indicated that participants were equivalent in terms of child age, duration of illness, and average HbA_{1c} values. Individuals failed to complete the protocol due to a lack of time or transportation problems, including too great a distance to travel.

The children were on an intensified diabetes regimen taking an average of 3.52 ($SD = 1.03$; range, 1–8) injections and 4.66 ($SD = 1.17$, range, 0–8) blood glucose tests per day. The average metabolic control over the year following completion of our protocol was 8.96 ($SD = 1.30$, range, 5.75–11.90). The majority of mothers (97%) were white and married (86%) and had at least some college education (88%); many reported a relatively high annual income, with more than 60% earning over \$50,000 (average Hollingshead Index was 4.17, indicating a medium business, minor professional class sample).

The study was approved by the University of Utah’s institutional review board and the Primary Children’s Medical Center. Mothers gave written informed consent and adolescents gave written assent.

Procedure

Potential participants were approached by a trained research assistant at either their regularly scheduled clinic visit or at diabetes summer camp. At the time of recruitment mothers and children were scheduled for a single 2-hour session at the university and were given separate survey packets to be completed individually. Participants were required to speak English as their primary language, as the questionnaires required a working knowledge of English. Those participants recruited via mail were sent a letter, contacted the office if interested, were mailed the questionnaires and consent/assent forms, and were scheduled for their lab session. Participants completed measures as part of a larger protocol and received \$20 compensation apiece for their participation.

Measures

Demographics

Demographic information was collected via a self-report questionnaire from mothers.

Maternal Behavioral Involvement in Diabetes Management Tasks

The responsibility items from the Diabetes Responsibility and Conflict Scale (Rubin et al., 1989) assessed mothers’ and children’s perceptions of who is responsible for completing various aspects of diabetes management (e.g., giving insulin) on a scale from 1 (*child does it alone*) to 3 (*mother and child share equally*) to 5 (*mother does it alone*). This scale is sensitive to the declines in maternal involvement that occur during adolescence (Rubin et al., 1989) and displays good reliability, with Cronbach’s α

of .79 (Rubin et al., 1989) and .89 (our sample, for both child and maternal reports). An error in material preparation led to the final item, "Who checks expiration dates on medical supplies?" being omitted from the maternal form. Thus, maternal forms consisted of 24 items, while the adolescent forms consisted of 25 items.

Autonomy

Children completed the 10-item self-reliance subscale of the Psychosocial Maturity Inventory (Greenberger et al., 1974) to measure the extent to which they had a sense of control over their lives and a sense of initiative without excessively depending on others. Participants rated each statement on a 1 (*not at all*) to 5 (*very true*) scale. This subscale has strong reliability and adequate validity (Cronbach- α values ranged from .69 to .82 in prior work and .62 in this sample; Greenberger et al., 1974).

Maternal Reasons for Transferring Diabetes Responsibility

A measure was created to explore mothers' reasons for the transfer of diabetes responsibility to their children. Mothers completed the sentence stems "My decision to give my child more responsibility for managing diabetes was/will be influenced by" from among 13 items (e.g., "finding it hard to help my child with his/her diabetes due to my schedule") on a scale of 1 (*not at all*) to 5 (*very much*) (see Table II for a complete list of items). The items were based upon the general diabetes literature (e.g., Allen, 1983; Johnson, 1995; La Greca, 1988) as well as the investigators' clinical experience with adolescents and their families living with diabetes.

Pubertal Status

Pubertal status was measured via mothers' reports of the extent to which their child displayed seven signs of puberty, four of which were specific to the sex of the child (e.g., genital and breast development, menarche, etc.) (Petersen, Crockett, Richards, & Boxer, 1988). Mothers completed these items on a 3-point scale, with 1 = *not at all*, 2 = *just started*, 3 = *a lot*, and an additional choice of *don't know*. An average score was calculated for this measure (i.e., average of all responses mothers gave, excluding *don't know*). Such a calculation was conducted in order to utilize fully the information mothers provided and to prevent the *don't know* responses from exerting undue influence on the puberty status scores. This scale has been shown to have adequate internal reliability (Cronbach's α for this sample: males = .95, females = .83) and validity;

mothers' ratings of their 11–13-year-old children correlate highly with physicians' Tanner staging of pubertal status (.89 for daughters and .68 for sons) (Miller, Tucker, Pasch, & Eccles, 1988).

Glycosylated Hemoglobin

Metabolic control was indexed via Hba_{1c} values reported in medical records. Hba_{1c} reflects the average level of blood glucose control over the prior 6–8 weeks, with higher numbers reflecting poorer control. Because we were interested in predicting the metabolic *consequences* of reduced maternal involvement, and because knowledge of metabolic control could influence children's and mothers' reports of autonomy and maternal involvement, only values indexing subsequent metabolic control were included (i.e., measures obtained at least 8 weeks after our protocol). Participants varied in the number and timing of recorded Hba_{1c} values as a function of their routine doctor visits. To ensure a reliable index of subsequent metabolic control for as many participants as possible, average Hba_{1c} values were recorded 2–12 months after our protocols were analyzed. Correlational analyses conducted on the multiple measures of Hba_{1c} revealed high intercorrelations ($r = .58$), justifying our combining the multiple assessments.

Results

Preliminary Analyses

All variables were checked for missing or out-of-range values and univariate/multivariate outliers, as well as for normalcy. The following analyses are based upon 125 mother-child dyads. One dyad was excluded because of missing pubertal status, and a second dyad due to missing child age. One case was identified as a multivariate outlier but was retained because the outcome of all analyses did not change when it was retained versus removed.

Overall, children reported high levels of self-reliance ($M = 4.06$, $SD = .50$), were at the midpoint of pubertal development ($M = 2.09$, $SD = .65$), and were involved at a somewhat independent level in managing their diabetes ($M = 2.55$, $SD = .53$). Duration of diabetes was negatively related to maternal report of the number of glucose tests conducted per day ($r = -.18$, $p = .04$), but was unrelated to all other variables including the dependent variables of diabetes responsibility and Hba_{1c} (Johnson & Meltzer, 2002).

Independent *t* tests revealed that females were significantly more self-reliant ($M = 4.15, SD = .45$ and $M = 3.97, SD = .53, t = -2.06, p = .04$) and exhibited more mature secondary physical characteristics ($M = 2.25, SD = .56$ and $M = 1.93, SD = .69, t = -2.90, p = .004$). No other gender differences were found. All mediational analyses worked similarly when gender was statistically controlled; thus, gender was excluded from analyses reported below.

Mothers and their children had highly correlated perceptions of who was responsible for completing daily diabetes management tasks ($r = .73, p = .0001$). However, a dependent *t* test ($t = 5.64, p = .001$) revealed that children reported less maternal involvement than mothers (children's $M = 2.55, SD = .53$; mothers' $M = 2.73, SD = .49$).

Hypothesized Model: Autonomy as a Mediator of the Effects of Age on Diabetes Responsibility

Regression analyses were used to examine autonomy as a mediator of age effects on both child and maternal reports of diabetes responsibility (Baron & Kenny, 1986). For mediation to be demonstrated, three requirements must be met (Judd & Kenny, 1981). First, age (predictor) must be related to report of diabetes responsibility (outcome). Second, age (predictor) must be related to autonomy (mediator). Third, autonomy must be related to report of diabetes responsibility (outcome) when age (predictor) is controlled, and the relation of age to report of diabetes responsibility (outcome) must be eliminated or reduced when autonomy (mediator) is controlled.

For child report of diabetes responsibility, the first requirement was met, as the regression of diabetes responsibility on age was significant, $F(1,124) = 74.06, p < .001$. With increasing age children reported completing diabetes management tasks more independently of the mother (first entry in Table I). The second requirement, that age be related to autonomy, was met as tested via regression using self-reliance as the dependent variable and age as the independent variable, $F(1,124) = 11.4, p < .001$. To assess the third requirement, a standard regression was conducted with child report of diabetes responsibility as the dependent variable and age and self-reliance as independent variables. This analysis yielded regression weights that represent the contribution of each variable controlling for the other. As can be seen in the second section of Table I, effects of both age and self-reliance were significant, suggesting that age continued to predict child report of diabetes

Table I. Analysis of Age Effects on Report of Diabetes Responsibility

Predictor	Child Report				Maternal Report			
	β	<i>t</i>	<i>df</i>	<i>p</i>	β	<i>t</i>	<i>df</i>	<i>p</i>
Age alone	-.61	-8.61	124	.000	-.58	-7.99	124	.000
Self-reliance as mediator								
Age	-.55	-7.63	123	.000	-.54	-7.19	123	.000
Self-reliance	-.22	-3.02	123	.003	-.14	-1.83	123	.069
R^2, F	.42	44.03			.36	34.21		
Pubertal status as mediator								
Age	-.44	-4.45	122	.000	-.30	-3.10	122	.002
Pubertal status	-.24	-2.42	122	.02	-.39	-3.96	122	.000
R^2, F	.39	39.23			.40	40.77		
All three predictors entered simultaneously								
Age	-.42	-4.40	121	.000	-.29	-3.00	121	.003
Self-reliance	-.20	-2.65	121	.009	-.10	-1.30	121	.20
Pubertal status	-.17	-1.77	121	.079	-.36	-3.57	121	.001
R^2, F	.43	29.78			.41	27.90		

responsibility when self-reliance was controlled. Therefore, autonomy did not fully mediate the effects of age on child report of diabetes responsibility. To further investigate whether partial mediation occurred, the Sobel test (Baron & Kenny, 1986; Clogg, Petkova, & Shihadeh, 1992) was conducted, testing for the indirect effect of age on child report of diabetes responsibility through self-reliance. This test was statistically significant (test statistic = $-2.27, p < .05$), indicating that partial mediation occurred (Baron & Kenny, 1986).

The same analyses were conducted for maternal reports of diabetes responsibility, with which age was associated, $F(1,124) = 63.85, p < .001$. As can be seen in the second column section in Table I, when age and self-reliance were used to predict maternal reports of diabetes responsibility, self-reliance was no longer a significant predictor (although it tended in that direction).

Hypothesized Model: Pubertal Status Mediates the Effects of Age on Report of Diabetes Responsibility

Similar regression analyses were used to examine pubertal status as a mediator of age effects on report of diabetes responsibility (Baron & Kenny, 1986). For adolescent report of maternal diabetes responsibility, age was negatively related to child report of diabetes responsibility (the first entry in Table I). Pubertal status was significantly predicted by age, $F(1,123) = 114.36,$

$p < .001$. Standard regressions were conducted with child report of diabetes responsibility as the dependent variable and age and pubertal status as independent variables. As can be seen in the third section of Table I, the effect of age remained significant when pubertal status was controlled, and the effect of pubertal status remained significant when age was controlled. Although pubertal status did not fully mediate the effects of age on child report of maternal diabetes responsibility, the Sobel test again revealed partial mediation (test statistic = -2.31 , $p < .05$). The same results were found when predicting maternal reports of diabetes responsibility (see second set of data in Table I). Although pubertal status did not fully mediate the effects of age on maternal report of diabetes responsibility, the Sobel test again revealed partial mediation (test statistic = -3.74 , $p < .05$).

In sum, the relation between age and both child and maternal reports of maternal involvement cannot be completely accounted for by autonomy or pubertal status. To explore whether age still accounted for a significant amount of variance in child and maternal reports of diabetes responsibility when both autonomy and puberty status were controlled, two simultaneous multiple regressions were conducted, one for child report and the other for maternal report of diabetes responsibility. The results indicate (see the bottom of Table I) that age continued to explain a significant amount of variance in both child and maternal reports of diabetes responsibility when self-reliance and pubertal status were controlled.

Individual Variability in Mothers' Reasons for Transferring Responsibility

The mean ratings of the 13 reasons evaluated appear in Table II. To explore individual variability in mothers' reasons for transferring responsibility, we conducted a principal-components analysis with varimax rotation. Four factors were uncovered, accounting for a total of 55.9% of the variance (see Table II for more information). The Cronbach- α value for the overall scale was .54. Items in bold reflect high loadings on each factor and were used to label the factors. The first component accounted for 18.38% of the variance and was labeled *Hassles*, loaded by items such as "Finding it hard to help my child with his/her diabetes due to my schedule." The second component was labeled *Promoting Responsibility*, loaded by such items as "Believing my child will better learn how to manage his/her diabetes if he/she takes more responsibility." The third component was labeled *Child Competence* and was loaded by such items as

"Believing my child is able to keep his/her diabetes in control on his/her own." The fourth component was labeled *External Pressure* and was loaded by such items as "Responding to my child's request for more responsibility for managing his/her diabetes." These data suggest that mothers respond to their child's level of competence and also transfer responsibility to promote competence. In addition, an important factor in individual variability in mothers' reasons for transfer is their feeling of being hassled concerning diabetes management. Interrelations among these data and other variables of interest (HbA_{1c} values, etc.) were examined and few significant relations were found.

Mothers' Involvement and Developmental Factors Predicting Glycosylated Hemoglobin Levels

To understand how perceptions of maternal involvement relate to metabolic control as a function of developmental factors, a series of moderation analyses were conducted with HbA_{1c} as the dependent variable. The number of participants in the moderation analyses, which differs from the number in other analyses, predicting HbA_{1c} values represents those for whom average HbA_{1c} values 2–12 months postprotocol completion could be obtained ($N = 100$). In the first analysis, the variables (centered) of self-reliance and child report of maternal diabetes responsibility were entered as independent variables in the first step of the model, and the interaction between self-reliance and child report of maternal diabetes responsibility was entered as an independent variable in the second step of the model. The interaction was statistically significant, $t(96) = 2.24$, $p = .027$, $\beta = .22$. Predicted means in Figure 1 demonstrate a strong relation between child reports of maternal diabetes responsibility and metabolic control for children low in self-reliance, and no relation for those high in self-reliance. Thus, children's views of higher amounts of maternal involvement (high scores of diabetes responsibility) are important for adequate metabolic control, primarily when children's autonomy is low. Similar analyses were conducted examining the interaction of pubertal status and child report of diabetes responsibility. This interaction was not significant, $t(96) = -.94$, $p = .35$, $\beta = .094$.

The same analyses were conducted for maternal reports of maternal diabetes responsibility. The interaction of maternal report and self-reliance was not

Table II. Principal-Components Analysis of Closed-Ended Reasons for Diabetes Transfer

Item	Mean (SD)	Component 1 (Hassles)	Component 2 (Promoting Responsibility)	Component 3 (Child Competence)	Component 4 (External Pressure)
1. "Finding it hard to help my child with his/her diabetes due to my schedule."	2.18 (1.27)	.79	.13	.11	-.05
2. "Finding it hard to help my child with her/his diabetes due to their schedule."	1.98 (1.21)	.75	-.05	-.09	-.05
3. "Feeling tired and burned out over having to help my child manage his/her diabetes."	1.72 (1.00)	.61	.23	-.07	.02
4. "Having conflicts with my child when I try to help her/him with her/his diabetes."	2.22 (1.29)	.59	-.21	-.09	-.05
5. "Believing my child will better learn how to manage his/her diabetes if he/she takes more responsibility."	4.09 (1.13)	-.03	.74	-.11	-.001
6. "Being concerned that my child is too dependent on me if I don't give her/him responsibility."	2.81 (1.40)	.32	.69	.19	-.02
7. "Believing my child is able to keep his/her diabetes in control on his/her own."	3.92 (1.25)	.05	-.001	.76	-.27
8. "Feeling my child knows how to manage her/his diabetes better than I do."	3.00 (1.55)	.26	-.44	.64	-.01
9. "Feeling comfortable with the idea that my child doesn't need my help as much as he/she used to."	3.89 (1.20)	-.36	.20	.53	.25
10. "Feeling like it's just the right time for my child to take responsibility."	3.76 (1.29)	-.006	.32	.52	.28
11. "Responding to my child's request for more responsibility for managing her/his diabetes."	3.47 (1.40)	-.30	-.07	.10	.70
12. "Having other people (e.g., friends, relatives, doctors, authors of books or articles) say my child should take on more responsibility."	1.54 (1.00)	.13	-.33	-.05	.64
13. "Worrying about how my child would manage his/her diabetes if something happened to me."	2.67 (1.30)	.28	.29	-.11	.62
Total variance explained = 55.91%		18.38%	12.78%	12.63%	12.11%

significant, $t(96) = .810$, $p = .42$, $\beta = .08$. However, the interaction of maternal report and pubertal status was significant, $t(96) = 2.03$, $p < .05$, $\beta = .202$. As can be seen in Figure 2, there was a strong relation between maternal reports of maternal diabetes responsibility and metabolic control for children with low pubertal status, but no relation for those of high pubertal status. Thus, mothers' views of maternal involvement (high scores of diabetes responsibility) are important for adequate metabolic control when children have lower pubertal status.

Discussion

The Role of Autonomy and Pubertal Status in Understanding Age Differences in Maternal Involvement

Our findings replicate previous work that demonstrates that mothers decrease their levels of involvement in managing their child's diabetes with increasing child age (Allen, 1983; La Greca, 1988; Rubin, Young-Hyman, & Peyrot, 1989) and suggest that the developmental processes contributing to the declines are likely to be quite complex. Although autonomy and pubertal status are important predictors of maternal involvement, they

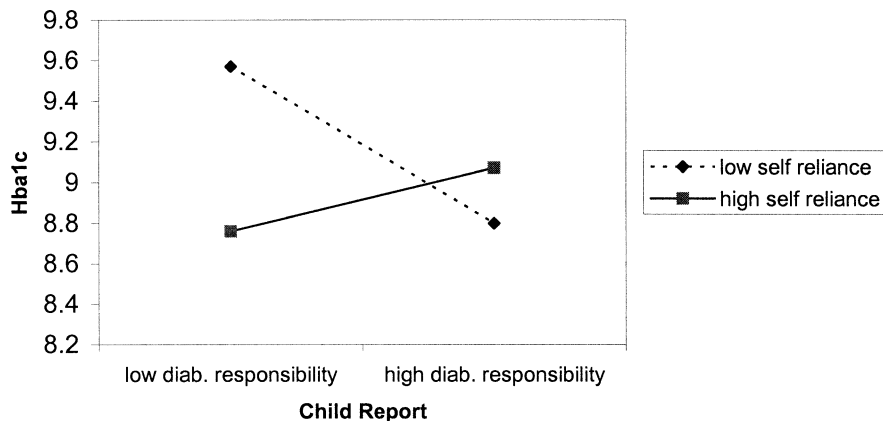


Figure 1. Children’s mean glycosylated hemoglobin (HbA_{1c}) values 2–12 months post-protocol completion as a function of child report of diabetes responsibility and self-reliance. Low and high diabetes responsibility reflects predicted means plotted 1 SD below (for low) and 1 SD above (for high) the mean. Similarly, low and high self-reliance reflects predicted means 1 SD below and 1 SD above the mean.

do not fully explain age-related effects. The age differences in maternal involvement were only partially mediated by autonomy and pubertal status, and when both autonomy and pubertal status were statistically controlled, age continued to predict unique portions of variance.

The importance of age over autonomy was unexpected given the importance ascribed to autonomy in normative adolescent developmental research (Offer, Ostrov, & Howard, 1981) as well as in diabetes-specific investigations (Anderson & Coyne, 1991). However, research on developmental expectations or implicit theories of development (Dekovic, Noom, & Meeus, 1997; Feldman & Quatman, 1988; Goodnow & Collins, 1990) indicates that parents and children use age to determine when specific developmental tasks and behaviors “should” be performed by children. In fact, age is the most important predictor of developmental expectations when considering other factors such as culture (Feldman & Quatman, 1988), gender, pubertal timing, and temperament (e.g., Dekovic, Noom, & Meeus, 1997). Future work comparing the declines in maternal involvement across domains (e.g., educational

involvement, diabetes involvement) utilizing samples of children without chronic illness may inform whether this process is similar for children with type 1 diabetes and those without. We should also note that although our measure of autonomy is among the most frequently used in the field, other measures such as the Ego Identity Interview (Grotevant & Cooper, 1985) and diabetes-specific autonomy measures may yield different results.

Our data suggest that the processes involved in transfer of responsibility may be somewhat different when considered from the perspective of children versus mothers. Autonomy was a somewhat more important predictor of child reports of maternal diabetes responsibility, while pubertal status was a more important predictor of mother reports of maternal diabetes responsibility. It may be particularly problematic that maternal involvement varies more as a function of the child’s physical maturation. That is, if mothers use pubertal status as a marker to transfer responsibility without the requisite autonomy and competence, poor adherence and poor metabolic control may result. In understanding these findings, we must acknowledge that these ideas are speculative and that the present study

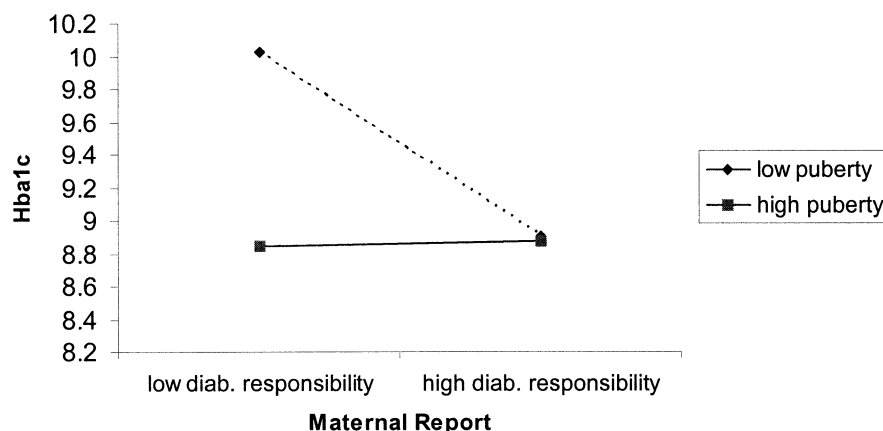


Figure 2. Children’s mean glycosylated hemoglobin (HbA_{1c}) values 2–12 months post-protocol completion as a function of mother report of diabetes responsibility and pubertal status. Low and high puberty reflect predicted means at 1 SD below (for low) and 1 SD above (for high).

cannot rule out method variance (i.e., the fact that autonomy is a child self-report and pubertal status is a mother report).

The result that children reported greater responsibility for daily diabetes management tasks than did mothers is consistent with the pattern of discrepancies between parents' and children's expectations for autonomy-related behaviors during adolescence. Children have consistently earlier timetables than parents (Dekovic, Noom, & Meeus, 1997; Feldman & Quatman, 1988), expecting to achieve developmental tasks or exhibit specific behaviors sooner than parents expect (Dekovic, Noom, & Meeus, 1997). This mismatch may be because mothers are not as aware of what their children are doing during adolescence given the increased time away from family (Larson & Richards, 1991). In addition, children may report higher levels of diabetes responsibility in order to promote a more independent or responsible image during adolescence.

Mothers' Ideas Regarding Transferring Diabetes Responsibility

Maternal reasons for transfer of diabetes responsibility with increasing age served as an important supplement to understanding why the hypothesized mediation models were not fully supported. Mothers' reasons for transfer were not due entirely to autonomy or physical maturity, but involved promoting child maturity and diabetes skills. This promotion of competence is consistent with the view from developmental psychology (Rogoff, 1991; Vygotsky, 1978) that parents proactively assist in the development of skills by providing a scaffold for emerging skills in the child.

Mothers' reasons provide insight into why they may be transferring diabetes responsibility to the child, and may be useful in designing interventions to assist mothers and children in this process. Currently most interventions and research emphasize children's competencies and skills in the completion of diabetes-related tasks as the basis for why and when diabetes responsibilities are transferred to the child (Anderson et al., 1990; Wysocki et al., 1996). However, mothers also described transferring responsibility because of the hassles and conflict that they experienced. Although hassles were not strongly endorsed by the majority of our sample (in terms of mean frequency), this factor accounted for the largest variance in the items, suggesting that it is an important factor contributing to individual differences among mothers. Mothers who transfer responsibility because they feel hassled may potentially benefit from

interventions that enhance existing support (e.g., husbands and family members) (Seiffge-Krenke, 2001) or provide alternative support networks (including surrogates who may provide temporary respite). The need for such interventions may be even greater than our results suggest. Our participants were largely well educated, married, and economically advantaged; mothers not falling within these categories (such as single mothers) may feel hassled at a higher frequency, potentially transferring diabetes responsibility to their children prematurely.

Mothers also reported feeling external pressures from others to transfer responsibility. Mothers and children manage the illness in the context of others who provide input and advice (solicited or unsolicited) suggesting when the transfer of responsibility for diabetes management should occur. Educational efforts could be directed at having parents and children consider their developmental expectations explicitly together with a realistic assessment of the child's maturity and competence at diabetes tasks.

Influence of Premature Transfer of Diabetes Responsibility on Glycosylated Hemoglobin Levels

The data clearly show that maternal involvement in diabetes responsibility interacts with children's developmental levels to predict HbA_{1c}, especially for children who are less developmentally advanced. However, the developmental factor that was important in understanding HbA_{1c} values was different when considered from the perspective of child versus mother reports of maternal involvement. When using child reports, mother's involvement was related to HbA_{1c} values primarily when children reported lower levels of self-reliance. When using mother reports, mother's involvement was important for understanding HbA_{1c} values primarily when mothers reported that their children showed lower pubertal status. These findings correspond to the earlier findings of slight differences in the developmental factors that are most predictive of maternal involvement (i.e., autonomy as more important for child reports; pubertal status for mother reports). Because children may use autonomy more as a marker for when mothers decrease their own involvement, low autonomy without the requisite maternal involvement may be particularly harmful for metabolic control. Maintained maternal involvement when the child demonstrates a low level of self-reliance may provide the scaffolding and more sophisticated assistance necessary for the successful

management of this demanding disease. From mothers' perspective, their decline in involvement across adolescence was more responsive to pubertal status, and maternal involvement was very important in understanding metabolic control for children of low pubertal status. These findings point to intriguing differences between mothers and children in the developmental factors that may be responsible for marking changes in maternal involvement across adolescence. Certainly our interpretations are tentative until follow-up work can be conducted. These initial findings, however, suggest that the child's maturity level may inform the most adaptive timing for transferring diabetes responsibility from the mother to the child.

Limitations and Conclusions

Although the study yielded valuable information concerning the decline in maternal involvement across adolescence, limitations did exist. First, the heavy reliance on self-report, paper-and-pencil measures of autonomy, pubertal status, and maternal involvement may be problematic (Johnson, Perwien, & Silverstein, 2000). Future work may benefit from the utilization of different response modalities, such as interviews (e.g., Anderson et al., 1999; Freund, Johnson, Silverstein, & Thomas, 1991). Second, the cross-sectional nature of our research precluded us from examining the age-change processes that we suggested occurred in the transfer of diabetes responsibility. Currently we are collecting longitudinal information from a subsample of our participants to examine these issues. Third, the lack of ethnic diversity and the high educational and economic status of our participants hinders the generalizability of our findings. Fourth, the recruitment procedures may have led to the exclusion of patients with the poorest diabetes control. The vast majority of participants were recruited during their routine 6-month checkup, thereby excluding individuals who had not been treated by medical personnel on a regular basis. Future research with more diverse samples of participants is needed to address these concerns. Finally, although our measure of mothers' reasons for transferring responsibility yielded information not previously revealed in the literature, future scale development is needed with this measure to improve psychometric properties.

The transfer of diabetes responsibility from parent to child occurs across adolescence in response to age, psychological and physical maturity, and diabetes-specific competencies as well as to the hassles of managing the illness and external pressures from others.

The finding that transfer of responsibility does not occur primarily due to the child's increasing autonomy may be problematic for metabolic control. Our research suggests many avenues for intervention that may help support parents of adolescents and foster the development of competence and independence in diabetes management during adolescence. Given the potential negative health consequences associated with diabetes management during adolescence and the fact that patterns laid down in adolescence are important for management during adulthood, the need is great for parents and children coping with type 1 diabetes to manage this transfer of responsibility effectively.

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