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Adolescent Information Management and Parental Knowledge in Non-Latino White and Latino Youth Managing Type 1 Diabetes

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Abstract

Objectives The objective of this study is to examine associations between adolescents' regulation of information about their type 1 diabetes (adolescent disclosure, secrecy), parental knowledge about their adolescent's diabetes management, diabetes outcomes (adherence, HbA1c), and depressive symptoms in Non-Latino White and Latino families. **Methods** In all, 118 adolescents (56 = Latino, 62 = Non-Latino White) completed surveys of disclosure to and secrecy from parents, parental knowledge of adolescent diabetes management, adherence, and depressive symptoms, and mothers completed measures of maternal knowledge and adolescent adherence. Glycemic control was extracted from medical records. Adolescents also completed structured interviews about parental knowledge about their diabetes-related problems. **Results** Interviews revealed that adolescent disclosure is the primary method by which parents gain knowledge about adolescent diabetes management problems. Adolescent disclosure to and secrecy from parents were uniquely associated with diabetes management and depressive symptoms independent of parental knowledge across ethnic groups; maternal reports of knowledge about her adolescent's diabetes care activities were associated with diabetes management independent of adolescent disclosure and secrecy. **Conclusions** Adolescent information management strategies are a primary means by which parents gain knowledge about diabetes, which may facilitate more effective management.

Key words: adherence; adolescence; depressive symptoms; diabetes; disclosure; parental knowledge; parental monitoring; secrecy.

Adolescence is a particularly challenging time for type 1 diabetes (T1D) management: pubertal hormones have a dysregulating effect on metabolic control, adherence is poorer, and emotional distress is higher than during childhood or adulthood (Cho, Craig, & Donaghue, 2014; Hood, Peterson, Rohan, & Drotar, 2009; Korbel, Wiebe, Berg, & Palmer, 2007). During this time of development, adolescents become more independent and assume greater responsibility for their diabetes management (Anderson et al., 2002; Mellin, Neumark-Sztainer, & Patterson, 2004; Wiebe et al., 2014), but management is better when parents remain engaged and knowledgeable of their adolescents' illness management (Berg et al., 2017). Indeed, parental knowledge about adolescents' T1D management has been associated with better adherence and metabolic control (King, Berg, Butner, Butler, & Wiebe, 2014).

Parental knowledge refers to what parents know about their adolescent's diabetes management activities. Traditionally, parental knowledge has been assumed to reflect parental behaviors such as parental monitoring, solicitation, and behavioral control. However, comprehensive reviews of decades of developmental psychology research have demonstrated that parental knowledge also reflects adolescent information management behaviors such as the spontaneous disclosure of personal information to parents (Stattin & Kerr, 2000). Studies from the developmental literature indicate that adolescent disclosure predicts parental knowledge with little contribution from parental solicitation or parental control (Keijsers, Frijns, Branje, & Meeus, 2009; Kerr, Stattin, & Burk, 2010; Smetana, 2008). For youth with diabetes, disclosing to parents may be beneficial by eliciting involvement from caregivers, while keeping secrets about diabetes management may preclude parents' effective involvement (Main et al., 2015).

It is important to note that spontaneous disclosure and secrecy (i.e., the purposeful concealment of information) may co-occur (Frijns et al., 2010). For example, an adolescent with T1D may disclose that they ate something that elevated their blood sugar, but keep secret that they skipped an insulin dose. Indeed, Osborn et al. found that adolescents' disclosure was related to better T1D management only when secrecy was low, and that keeping diabetes-related secrets from parents was associated with higher depressive symptoms independent of disclosure (Osborn, Berg, Hughes, Pham, & Wiebe, 2013). In a sample of older adolescents (a developmental period when disclosure typically declines), secrecy from parents was associated with poorer metabolic control and adherence above and beyond disclosure (Main et al., 2015).

Adolescent information management strategies appear to contribute to parental knowledge and adolescent T1D outcomes, but it remains unclear precisely how parents learn of their adolescents' diabetes-related problems in daily life. There is increasing evidence that adolescents and their parents co-regulate the flow of information about diabetes management (Berg et al., 2017b; Solís, Smetana, & Comer, 2015; Tilton-Weaver, 2014; Wiebe, Helgeson, & Berg, 2016), with the processes of adolescent information management and parental monitoring behaviors (e.g., soliciting information, behavioral control) operating in tandem. Thus, it is important for research to examine not only how parent involvement and knowledge are associated with adolescent diabetes management, but also the active role that adolescents play in managing the information to which parents have access. Such research may point to new or more targeted interventions to promote family management of diabetes during adolescence.

The aforementioned work has been conducted primarily with European American samples, despite the fact that the incidence of T1D among ethnic minority youth, particularly Latinos, is increasing (Mayer-Davis et al., 2017). Latino adolescents are understudied, but are the fastest-growing minority group in the United States (U.S. Census Bureau, 2010). The literature is inconsistent on whether Latino youth have poorer T1D management than Non-Latino White (NLW) youth (Mello, Wiebe, Barranco, & Barba, 2017). However, symptoms of depression are often elevated in Latinos without T1D (Twenge & Nolen-Hoeksema, 2002), and these symptoms may be exacerbated in Latinos with T1D, as adolescents with T1D often report higher rates of depression compared with healthy adolescents (Reynolds & Helgeson, 2011). In addition, parent–child navigation of adolescence may differ cross-culturally (Roche et al, 2014), and relationship quality and dyadic perceptions of diabetes management problems differ across NLW and Latino families (Main et al., 2014; Mello et al., 2017). It has been theorized that Latino adolescents desire greater autonomy from their parents (Fuligni, 1998) and may strategically disclose less, but the few studies that have assessed ethnic differences find no differences between groups after adjusting for socioeconomic status (SES) (Hunter, Barber, Olsen, McNeely, & Bose, 2011; Main et al., 2014). No study has examined ethnic differences in diabetes disclosure and secrecy.

Drawing on an existing sample of Latino and NLW adolescents and their mothers, we used survey and interview methods to examine (a) whether and how parents know about adolescents' day-to-day diabetes-related problems, and (b) unique associations of adolescent disclosure to and secrecy from parents and parental knowledge about adolescents' diabetes management with metabolic control, adherence, and depressive symptoms. We hypothesized that parental knowledge of adolescent diabetes management would mainly reflect adolescent disclosure about diabetes-related problems to parents, rather than parental monitoring behaviors. We further hypothesized that adolescent information management (disclosure and secrecy) and parental knowledge of adolescent diabetes management would be independently associated with outcomes. Although we had no specific hypotheses regarding directionality, we also explored ethnic differences in associations between adolescent information management, parental knowledge, diabetes management outcomes, and depressive symptoms.

Method

Participants

Participants were 118 adolescents (56 = Latino, 62 = NLW) with T1D and their mothers recruited

from a large pediatric endocrinology clinic in an urban southwestern US city. Adolescents 10–15 years of age were recruited if they had been diagnosed with diabetes for at least 1 year, self-identified as NLW or Latino, and could read and speak English or Spanish. Early adolescence was targeted because it is a period of rapid autonomy development when parental involvement and knowledge decline, and adherence and glycemic control deteriorate (King et al., 2014; Wiebe et al., 2005). Mothers were recruited because they are most often the primary caregivers in families with chronically ill children. For each adolescent, one mother who lived with the adolescent at least 50% of the time was recruited. Stepmothers or adopted mothers were eligible if they had lived with the adolescent for at least 1 year. Adolescents also reported on the father most involved in their diabetes care. Of the 246 qualifying individuals approached, 118 (48%) agreed to participate and were enrolled, while 63 (25.6%) refused. An additional 65 (26.4%) expressed a desire to participate, but could not be reached to schedule a research appointment. Reasons for refusal included distance or transportation problems (27%), too busy (33%), and scheduling conflicts (40%). Comparisons of eligible adolescents who participated versus those who did not revealed no differences in sex, age, ethnicity, pump status, or glycated hemoglobin (HbA1c) (p values $> .05$).

Procedure

This study was part of a larger study examining parent–adolescent relationships and T1D management in Latino and NLW families (see Main et al., 2014; Mello et al., 2017 for details), and was approved by the institutional review board. At recruitment, participants received consent and assent forms to review before a later research appointment. Mothers and adolescents completed structured interviews, as well as questionnaires on a computer. For the purpose of the present study, only the adolescent interview data were analyzed, as the mothers' interview did not ask how mothers knew about adolescent diabetes problems. Participants received a tutorial on completing electronic surveys and were provided a paper survey option. All measures were translated and back translated from English to Spanish by bilingual staff. Each participant received a $40 gift card.

Measures

Demographics

Less than half of Latina mothers reported English as the primary language spoken at home (43%); 25 mothers and two adolescents completed the measures in Spanish. Mothers reported their highest education, and neighborhood median family income was collected from census tract data based on zip codes. A composite SES variable was created by standardizing and computing the mean of neighborhood income and mother education to reduce the number of variables in analyses; these variables have been linked with HbA1c in prior research (Wang, Wiebe, & White, 2011).

Interview Coding

During a structured interview, adolescents identified up to two diabetes-related problems from the past week; if they could not identify a diabetes event, they described the most problematic event of the week. Most (99.1%) adolescents were able to identify a first diabetes-related problem, and 95.5% were able to identify a second. Content coding of these events indicated problems were primarily related to blood glucose fluctuations and hassles of managing diabetes (e.g., having high or low blood glucose; forgetting to check blood glucose) (Main et al., 2014; Mello et al., 2017), problems that may benefit from parental help if parents were aware. Adolescents indicated whether and how mothers and fathers knew about each event. Transcripts of audiotaped interviews were used to develop a coding system to categorize how parents learned about the diabetes problems (Table I). Two researchers listened to 20% of randomly selected adolescent interviews to identify conceptual themes, and through an iterative process, these themes were discussed and operationalized, yielding 10 categorical domains. Two trained research assistants coded 10% of the interviews to establish reliability (Kappa $> .90$ for each code). One assistant coded all remaining interviews. Coding was discussed at routine meetings throughout to minimize coder drift, and any questionable codes were determined by consensus.

Diabetes Disclosure and Secrecy

Adolescents completed a diabetes-specific scale of disclosure and secrecy that was developed and validated by Osborn et al. (2013). Adolescents reported on disclosure to and secrecy from mothers and fathers separately. Disclosure was measured with three items (e.g., "I spontaneously tell my [mother/father] about what is going on with my diabetes management, without [him/her] asking") and secrecy with two items ("I keep a lot of secrets from my [mother/father] about my diabetes management" and "I hide a lot from my [mother/father] about my diabetes management on nights and weekends when I am away from [him/her]"). Items were rated on a 1 (*strongly disagree*) to 5 (*strongly agree*) scale and averaged; higher scores reflect higher disclosure and secrecy. Reliability in this sample was $\alpha = .77$ and .84 for adolescent report of disclosure and $\alpha = .80$ and .85 for adolescent report of secrecy from mothers and fathers, respectively. Because diabetes secrecy and disclosure are distinct

Table I. *Means, standard deviations, and correlations among study variables*

Variable	Non-Latino White *M (SD)*	Latino *M (SD)*	Full sample *M (SD)*	Disc-M (A)	Sec-M (A)	Kno-M (A)	Kno-M (M)	Disc-F (A)	Sec-F (A)	Kno-F (A)	HbA1c	Adh (A)	Adh (M)	Dep (A)
Disclosure to mother (A)	5.51 (1.15)	3.77 (1.03	3.63 (1.10)	–										
Secrecy from mother (A)	1.85 (1.14)	1.71 (1.00)	1.79 (1.07)	−.24**	–									
Maternal knowledge (A)	3.83 (1.01)	4.10 (0.81)	3.95 (0.93)	.60***	−.32***	–								
Maternal knowledge (M)	4.20 (0.57)	4.38 (0.57)	4.28 (0.57)	.31**	.03	.35***	–							
Disclosure to father (A)	3.01 (1.23)	2.86 (1.31)	2.94 (1.26)	.53***	−.21*	.36***	.13	–						
Secrecy from father (A)	1.84 (1.10)	1.94 (1.22)	1.89 (1.15)	−.23*	.45***	−.18	−.13	−.15	–					
Paternal knowledge (A)	3.33 (1.31)	2.85 (1.36)	3.10 (1.35)	.28**	−.08	.38***	.31**	.61***	−.21*	–				
HbA1c	8.35 (1.43)	8.77 (1.67)	8.55 (1.55)	−.24**	.12	−.07	−.25**	−.33***	.25**	−.27**	–			
Adherence (A)	4.09 (0.57)	3.97 (0.78)	4.04 (0.68)	.40***	−.33***	.39***	.30**	.30**	−.25**	.32**	−.22*	–		
Adherence (M)	3.82 (0.74)	4.01 (0.72)	3.91 (0.73)	.17	−.10	.13	.48***	.13	−.07	.20*	−.27**	.30**	–	
Depressive symptoms	7.69 (5.32)	9.11 (6.83)	8.36 (6.09)	−.37***	.28**	−.37***	−.09	−.33***	.24*	−.33***	.20*	−.50***	−.14	–
Female sex, %	46.77	62.50	54.23	−.02	−.04	−.01	.11	−.02	−.13	−.00	−.15	−.19*	.04	.09
Adolescent age (years)	13.12 (1.63)	13.30 (1.78)	13.24 (1.69)	−.37***	.14	−.35***	−.49***	−.38***	.10	−.39***	.20*	−.25**	−.20**	.15
Mother education[a]	Partial college	High school graduate	Partial college	−.16	−.12	−.17	−.04	.10	−.21*	.17	−.15	.10	.03	−.04
Median family income[a]	$72,924 ($28,078)	$50,493 ($18,512)	$62,699 ($26,196)	−.01	−.10	−.13	−.09	.16	−.14	.15	−.22*	.15	−.02	−.18
Time since diagnosis (years)	4.90 (3.14)	4.31 (2.45)	4.62 (2.84)	−.03	.12	−.17	−.12	−.02	.11	−.06	.23*	.04	−.16	.12
Pump status, % yes	30.6	19.6	25.4	.03	.08	.06	.03	−.16	.08	−.13	.23*	−.12	.01	.10

Note. *M* = mean; *SD* = standard deviation; (A) = adolescent report; (M) = mother report. Disc-M = disclosure to mother; Sec-M = secrecy from mother; Kno-M = maternal knowledge of adolescent T1D management; Disc-F = disclosure to father; Sec-F = secrecy from father; Kno-F = paternal knowledge of adolescent T1D management; Adh = adherence; Dep = depressive symptoms.

*$p < .05$; **$p < .01$; ***$p < .001$.

[a]Latino and Non-Latino White sample differed at $p < .05$.

constructs (Main et al., 2015), we analyzed these variables separately.

Parental Knowledge

Adolescents and mothers completed a six-item diabetes-specific scale of parental knowledge (Berg et al., 2008) based on Barber's (1996) general parental monitoring scale. Adolescents reported separately how much mothers and fathers "really" know, and mothers reported how much they themselves "really" know about different aspects of the adolescent's diabetes care on a scale of 1 (*doesn't know*) to 5 (*knows everything*). This scale longitudinally predicts adherence among adolescents with diabetes (King et al., 2014). Average scores were analyzed. Reliability in this sample was $\alpha = .89$ and .96 for adolescent report on mother and father knowledge, respectively, and $\alpha = .89$ for mother-reported knowledge.

Adherence

The Self-Care Inventory (La Greca, Follansbee, & Skyler, 1990; Lewin et al., 2009) was adapted to measure adherence to various diabetes tasks (e.g., checking blood glucose, eating proper foods). This adapted version included two additional items to capture current regimens, and has been shown to be reliable and valid in multiple samples of adolescents with T1D (Main et al., 2014; Berg et al., 2017; Wiebe et al., 2005; Wiebe et al., 2014). Adolescents and mothers reported adherence over the past month on a scale of 1 (*never did it*) to 5 (*always did this as recommended without fail*) or "not applicable"; average scores were analyzed ($\alpha = .85$ and .92 for adolescent and mother reports).

Metabolic Control

Metabolic control was indexed by HbA1c extracted from medical records. HbA1c represents the average blood glucose over the prior ~3 months, with higher levels indicating poorer metabolic control. Point of care assays were obtained using the DCA Vantage (Siemens, Malvern, PA). The measure obtained at the recruitment visit was used to capture HbA1c nearest to the study assessment.

Adolescent Depressive Symptoms

Adolescents completed the Children's Depression Inventory (Kovacs, 1985) to indicate their level of depressive symptoms in the past 2 weeks (e.g., 1 = *I am sad once in a while*, 2 = *I am sad many times*, 3 = *I am sad all the time*). This 27-item scale has strong reliability and is related to diabetes management (Grey, Davidson, Boland, & Tamborlane, 2001; Main et al., 2014). Summed scores were analyzed ($\alpha = .82$).

Data Analysis Plan

SPSS version 24 was used to conduct the analyses, with significance level set at $p < .05$. To examine whether and how parents know about diabetes problems, adolescents' structured interview data were analyzed. The percentage of mothers and of fathers who, based on adolescent report, knew about each diabetes problem was calculated. Chi-square tests determined whether there were knowledge differences by parent gender and ethnicity for each event. For each event that mothers/fathers knew, participants received a score of 0 (i.e., code was not endorsed) or 1 (code was endorsed) for each of the 10 codes. We calculated the percent of participants endorsing each code, separately for reports on mothers and fathers. For nonrare codes (i.e., endorsed five or more times), chi-square tests were used to identify differences in code frequencies by parent gender and ethnicity.

Bivariate correlations and hierarchical multiple regressions were conducted to examine whether adolescent information management and parental knowledge had unique associations with each outcome (i.e., HbA1c, adolescent- and mother-reported adherence, depressive symptoms). In Step 1, the covariates (adolescent sex, age, SES, time since diagnosis, pump status, and ethnicity) were entered. In Step 2, disclosure and secrecy were entered. In Step 3, parental knowledge was entered, allowing us to examine unique effects of parental knowledge and adolescent information management for each dependent variable. Given the importance of father involvement in youth with chronic illness (Wysocki & Gavin, 2006), mother and father variables were examined separately. Further, separate analyses of mother variables were conducted for adolescent- and mother-reported maternal knowledge, resulting in a total of 12 regression analyses. Given the significant correlations among parental knowledge, adolescent disclosure, and secrecy, we examined the tolerance statistics and variance inflation factors for all regressions. All values were in the acceptable range (Hair, Anderson, Tatham, & Black, 1995).

Results

Adolescents were 54% female, had a mean age of 13.24 years, and had been diagnosed an average of 4.62 years. Mothers were primarily biological (92%) and married (75%), and 73% reported living in two-parent households with the participating adolescent's father. There were no ethnic differences in these family composition variables. Most adolescents followed a regimen of multiple daily injections; consistent with general treatment procedures at the participating clinic, 25% were on an insulin pump. Most of the Latino sample was composed of second- or third-generation English-speaking Mexican

Americans: 12% were first generation, with adolescents and mothers born outside of the United States, 57% were second generation, with adolescents born in the United States and mothers born outside the United States, and 31% were third generation, with adolescents and mothers born in the United States. Mexico was the country of origin of 84% of the Latino sample, with the remaining from Puerto Rico, Argentina, Bolivia, El Salvador, and Guatemala. As noted in Table I, there were no ethnic differences on primary study variables, but Latino participants had significantly lower SES than NLWs ($t(116) = 7.14$, $p < .001$).

Structured Interviews

Adolescent interviews were analyzed to examine whether and how parents knew about adolescents' diabetes-related problems. Adolescents reported that mothers were more likely than fathers to know about adolescents' first (77.6 vs. 51.8%), $\chi^2 = 11.18$, $p < .01$, and second diabetes problems (78.5 vs. 45.1%), $\chi^2 = 19.92$, $p < .001$. There were no ethnic differences in these percentages.

Adolescents reported a variety of ways by which parents learned about their diabetes problems. As described in Table II, 10 conceptual categories emerged. The most frequent way both mothers and fathers learned of their adolescents' diabetes problems was *adolescent discloses to parent*. The second most frequent code for mothers was *parent present observes*, while the third most frequent code for fathers was *parent discloses to the other parent*.

We also examined differences between Latinos and NLWs in how parents learned about adolescents' diabetes-related problems. For both events, NLW adolescents were coded as *adolescent discloses to father* more than Latino adolescents, $\chi^2(1) = 6.09$, $p = .01$ and $\chi^2(1) = 4.16$, $p = .04$.

Associations Among Information Management, Parental Knowledge, and Outcomes

Zero-order correlations reported in Table I generally revealed disclosure to mothers and fathers were positively correlated with one another and negatively correlated with secrecy from both parents. Higher disclosure to both parents was also generally correlated with higher mother and father knowledge of adolescent's diabetes management. Secrecy from mothers was related to lower adolescent-reported maternal knowledge, but not to mother reports of her own knowledge nor to paternal knowledge; secrecy from fathers was related to lower paternal but not to maternal knowledge. Disclosure to mothers and fathers was associated with better HbA1c and adolescent-reported adherence, and fewer depressive symptoms. Secrecy from both parents was associated with worse adolescent-reported adherence and depressive symptoms, but only secrecy from fathers was associated with worse HbA1c.

Table III presents the unique associations of adolescent information management (disclosure and secrecy) and parental knowledge variables with diabetes outcomes (HbA1c, adherence) and depressive symptoms. For regressions with mother variables as predictors in Step 2, disclosure to mothers was uniquely associated with better metabolic control, better adolescent-reported adherence, and fewer depressive symptoms independent of secrecy and covariates (adolescent sex, age, SES, illness variables, and ethnicity). Conversely, secrecy from mothers was uniquely associated with worse adolescent-reported adherence and more depressive symptoms, independent of disclosure and covariates. When mother knowledge was entered as an additional predictor in Step 3, disclosure to and secrecy from mothers maintained their unique associations with metabolic control, adherence, and depressive symptoms, with one exception; secrecy was no longer associated with depressive symptoms when adolescent-reported maternal knowledge was controlled. Mother-reported knowledge had unique associations with both adolescent- and mother-reported adherence in Step 3, while adolescent-reported maternal knowledge was unrelated to all outcomes in Step 3.

For regressions with father variables as predictors in Step 2 (see bottom panel of Table III), disclosure to and secrecy from fathers showed a similar pattern to findings for mothers. In Step 3 when father knowledge was entered, disclosure to fathers maintained a unique association with better metabolic control, but was no longer associated with adolescent-reported adherence or depressive symptoms. Secrecy from fathers maintained unique associations with adolescent-reported adherence and depressive symptoms after knowledge was included in the model. Father knowledge had no unique associations with dependent variables in Step 3. No study variables had unique associations with mother-reported adherence.

To explore whether ethnicity moderated associations of disclosure, secrecy, or knowledge with outcomes, interaction terms for each variable were examined in Step 4. Given the exploratory nature of these analyses, ethnicity interactions with each variable were analyzed separately (36 total tests). Only 3 of 36 tests were significant at $p < .05$, and did not follow a consistent pattern. To understand possible ethnic differences more fully, these moderation tests were also conducted without covariates in the models; results were unchanged across analyses. We interpret these as chance findings and do not discuss them further.

Table II. *Frequency of codes for how mothers and fathers gain knowledge about adolescents' diabetes-related stressors*

Name and description of code	Example(s)	% for mother		% for father	
		Stressful Event 1	Stressful Event 2	Stressful Event 1	Stressful Event 2
Adolescent discloses to parent: Spontaneous (not solicited) disclosure of the adolescent to the parent.	"I called my mom and told her." "Mom was in the kitchen too and I told her."	62.79	63.38	50.88	69.05
Doctor/nurse discloses to parent: Medical professional tells parent.	"The school nurse called my mom about what had happened in PE."	8.14	3.85	0	0
Parent discloses to the other parent: One parent tells the other parent.	"Mom told dad." "Dad told mom."	0	1.28	1.16	14.29
Someone else discloses to parent: Someone other than adolescent, medical professional, or the other parent tells parent (e.g., sibling, friend, teacher).	"My sister told my mom that I was having symptoms."	1.16	2.56	1.75	0
Parent present observes: Parent observes the event, notices the adolescent's symptoms, or observes the adolescent performing a diabetes-related behavior during or in response to the event.	"Because mom was there." (unspecified) "Because my mom was around when I checked my blood sugar." "I threw up at the restaurant and my mom saw." "At night when my mom felt my back, she noticed that I was warm and wondered whether she gave me the flu."	15.12	14.1	7.02	7.14
Parent present active in diabetes-related event: Parent learns of the event while performing a diabetes task with or for the adolescent.	"Mom was helping me figure out how many carbs I had eaten." "My parents were checking my blood sugar when I was asleep in the middle of the night, and the meter said it was low."	1.16	5.13	0	0
Parent solicits adolescent: Parent asks the adolescent directly.	"Mom asked me if I was low."	5.81	2.56	5.26	2.38
Parent solicits someone other than adolescent: Parent solicits information from someone other than the adolescent.	"My mom always talks with my teachers."	1.16	0	0	0
Parent learns inadvertently: Parent learns inadvertently, without seeking information or being directly told by any source.	"Mom noticed that the cupcakes were missing." "Mom overheard me telling dad."	3.49	1.28	1.75	7.14
Parental behavioral control: Parent structures the environment to be knowledgeable about the adolescent's diabetes management.	"I put my blood sugar levels down on the chart in the kitchen that my mom makes me use every day for tracking."	1.16	3.85	0	0

Discussion

The present study demonstrates the importance of adolescent information management strategies in meeting the primary treatment goals of T1D management—facilitating adherence to maintain good metabolic control, while supporting psychological well-being. Results suggest that adolescent information management strategies (disclosure to and secrecy from parents) have significant associations with metabolic control, adherence, and depressive symptoms above and beyond parental knowledge about adolescents' T1D management. Prior work has demonstrated parental involvement in, and knowledge about their child's diabetes management, predict slower declines in adherence across adolescence (King et al., 2014). Current findings indicate that adolescents play an active role in this aspect of parental involvement through their choices to disclose or keep secret information about their diabetes management experiences. Strengths of the study included the use of both survey and interview methods in an ethnically diverse sample to examine adolescent information management strategies in a diabetes context.

Interviews with adolescents confirmed that disclosure is the primary method by which adolescents report their parents gain knowledge about diabetes

Table III. *Multiple regressions predicting glycemic control, adherence, and depressive symptoms from disclosure to parents, secrecy from parents, and parental diabetes knowledge*

Variable	DV: HbA1c		DV: Adherence (A)		DV: Adherence (M)		DV: Depressive symptoms	
	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2
Regressions using mother variables as predictors (adolescent-reported knowledge in Step 3)								
Step 1		.23***		.11*		.11*		.07
Adolescent sex (0 = male, 1 = female)	−.22*		−.18		−.27**		.08	
Adolescent age	.14		−.24**		.13		.13	
Socioeconomic status	−.19		.03		−.13		.01	
Time since diagnosis	.31**		.03		.01		.16	
Pump status	.26**		−.08		.16		.12	
Ethnicity (0 = Non-Latino White, 1 = Latino)	.07		−.02				.10	
Step 2		.06*		.18***		.00		.16***
Disclosure to mother (A)	−.27**		.31**		.07		−.36***	
Secrecy from mother (A)	−.04		−.26**		−.00		.19*	
Step 3		.01		.02		.00		.02
Disclosure to mother (A)	−.33**		.22*		.09		−.26*	
Secrecy from mother (A)	−.01		−.22*		−.01		.15	
Mother diabetes knowledge (A)	.14		.20		−.05		−.20	
Regressions using mother variables as predictors (mother-reported knowledge in Step 3)								
Step 3		.02		.05**		.13***		.00
Disclosure to mother (A)	−.24*		.26**		−.01		−.36***	
Secrecy from mother (A)	−.02		−.28**		−.08		.20*	
Mother diabetes knowledge (M)	−.16		.28**		.44***		−.04	
Regressions using father variables as predictors								
Step 1		.24***		.12*		.10		.07
Adolescent sex (0 = male, 1 = female)	−.21*		−.19		.01		.09	
Adolescent age	.15		−.23*		−.25**		.10	
Socioeconomic status	−.19		.08		.10		−.05	
Time since diagnosis	.32**		.03		−.13		.16	
Pump status	.25**		−.11		.02		.15	
Ethnicity (0 = Non-Latino White, 1 = Latino)	.06		.05		.14		.04	
Step 2		.06*		.09**		.00		.12**
Disclosure to father (A)	−.23*		.19*		.03		−.29**	
Secrecy from father (A)	.10		−.25**		−.01		.21*	
Step 3		.00		.02		.01		.02
Disclosure to father (A)	−.23*		.10		−.06		−.21	
Secrecy from father (A)	.10		−.24*		.01		.19*	
Father diabetes knowledge (A)	.00		.17		.16		−.17	

Note. (A) = adolescent report, (M) = mother report, DV = dependent variable.

*$p < .05$; **$p < .01$; ***$p < .001$.

In all steps of the model, covariates (adolescent age, sex, socioeconomic status, ethnicity, pump status, and time since diagnosis) were entered.

problems. This extends recent theory in the general developmental literature to the diabetes context that adolescent disclosure is more strongly associated with parental knowledge than is parental solicitation or behavioral control (Keijsers et al., 2009; Kerr et al., 2010; Smetana, 2008). Latino adolescents reported less disclosure to fathers than NLW adolescents, suggesting there may be cultural differences in adolescent disclosure patterns. Though there were no ethnic differences in survey measures of disclosure and secrecy, findings support future studies on cultural aspects of T1D management.

Adolescent information management strategies (particularly disclosure) were uniquely associated with adherence, metabolic control, and depressive symptoms above and beyond parental knowledge. The finding that associations with outcomes occurred independent of parental knowledge suggests disclosure and secrecy do more than simply keep parents informed. The act of disclosure may engage parents as collaborative partners or help adolescents glean a new understanding of their diabetes problems (Wiebe et al., 2005). Similarly, the process of keeping secrets may be psychologically or physically taxing, or may undermine other aspects of parent–adolescent relationships (Main et al., 2015; Osborn et al., 2013).

Findings confirmed that secrecy and disclosure are distinct aspects of how adolescents manage the flow of

information about diabetes to parents. For example, adolescent reports of secrecy were negatively associated with adolescent—but not mother—reports of maternal knowledge, while adolescent disclosures were positively associated with both reports of maternal knowledge. This pattern implies that mothers are not always aware of the things their adolescents keep secret. It is notable that mother reports (but not adolescent reports) of knowledge were also associated with adherence, above and beyond these information management strategies. Thus, mothers appear to be aware of adolescent diabetes management in ways that extend beyond adolescent secrecy and disclosure. These findings together suggest that diabetes management is a co-regulatory, transactional process in which both adolescents and parents play an active role, and are consistent with perspectives that adolescent and parent diabetes management activities reflect a coordinated process across time (Berg et al., in press).

Findings from the surveys were generally consistent across ethnic groups. There were no mean-level ethnic differences on study variables, and associations of adolescent information management and parental knowledge with outcomes were similar across ethnicity. Prior studies of ethnic differences in family T1D management have indicated that Latino adolescents have higher diabetes-related conflict and lower relationship quality with parents (Main et al., 2014), as well as lower congruence with mothers on diabetes stress perceptions compared with NLW adolescents (Mello et al., 2017). The absence of ethnic differences in the present study suggests these prior findings are unlikely to reflect aspects of adolescent secrecy and disclosure or parental knowledge. Nevertheless, future research with larger samples of Latino youth that measure cultural processes directly remains a high priority to understand ethnic differences in parent–adolescent T1D management.

There are several limitations in the present study. First, the cross-sectional nature of the study precluded the ability to test causal explanations. It is possible that the present findings partly reflect that adolescents disclose less or keep more secrets when their diabetes management is not going well. Second, though both questionnaire and interview methods were used, most reports were gathered from adolescents, who may have overreported disclosure or underreported secrecy. Third, while multireporter information was collected, fathers did not participate in the current study, so information about fathers was based solely on adolescents' reports. Fourth, our sample had a low rate of insulin pump use, which may affect generalizability to other samples; we note, however, that pump use in this sample was representative of the clinic population and pump status was covaried in all analyses. Finally, self-identified Latino adolescents were recruited and treated as a single group, despite heterogeneity within Latino cultures (Calzada, Huang, Anicama, Fernandez, & Brotman, 2012).

Findings hold implications for families and clinicians who work to enhance diabetes management during adolescence. Interventions to enhance parental knowledge may target both parents and adolescents. Technologies such as insulin monitoring apps or remote access to blood glucose data may help parents be informed without relying on adolescent disclosures or openly intruding on adolescents' privacy (Cengiz, 2013). Because the links of disclosure and secrecy to diabetes outcomes generally remained when controlling for parental knowledge, it may also be useful to facilitate adolescents' discussions about diabetes management experiences with parents. Perhaps one way to do so is to normalize adolescents' needs for increased privacy and independence in some life domains, but to emphasize that their diabetes is a domain (Smetana, 2008) where it is imperative to disclose more and keep fewer secrets. Encouraging adolescents to share information about their diabetes management activities with their parents may facilitate more positive health outcomes in this vulnerable population.

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