Published in final edited form as:

Pediatr Diabetes. 2022 November ; 23(7): 1133–1142. doi:10.1111/pedi.13397.

Latent classifications of parental involvement in diabetes management for youth with type 1 diabetes: A randomized clinical trial

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Abstract

Objective: Understanding how parent–child relationships influence diabetes management in youth with type 1 diabetes is critical for minimizing the risk of short- and long-term complications. We examined how classes of diabetes-specific parenting behaviors are associated with disease management and well-being for youth with type 1 diabetes.

Research Design and Methods: The Family Management of Diabetes clinical trial tested the efficacy of a 2-year behavioral intervention for families of youth with type 1 diabetes. Three hundred and ninety youth diagnosed with type 1 diabetes and their primary caregiver were recruited from four pediatric endocrinology centers in the US Classifications of parental involvement utilized baseline parent and youth reports of task involvement, collaborative

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AUTHOR CONTRIBUTIONS

Chelsie D. Temmen, Ruijin Lu, Benjamin T. Gee, Zhen Chen, and Tonja R. Nansel designed research; Tonja R. Nansel acquired data, Ruijin Lu and Zhen Chen analyzed data, all authors wrote paper; Chelsie D. Temmen, Zhen Chen, and Tonja R. Nansel had primary responsibility for final content, and Tonja R. Nansel and Zhen Chen are co-corresponding authors. All authors read and approved the final manuscript.

CONFLICT OF INTEREST

All authors report no conflicts of interest.

PEER REVIEW

The peer review history for this article is available at https://publons.com/publon/10.1111/pedi.13397.

ETHICS STATEMENT

All study protocols were approved by the Eunice Kennedy Shriver National Institute of Child Health and Human Development Institutional Review Board and the institutional review boards of all participating institutions.

TRIAL REGISTRATION

Clinicaltrials.gov: NCT00273286.

involvement, and parent–youth conflict. Class differences in baseline glycemic control (HbA1c), regimen adherence, general and diabetes quality of life, and depressive symptoms, and 2-year change in HbA1c were examined.

Results: Latent profile analysis identified three classes: (1) high in task and collaborative involvement, low in conflict (Harmonious), (2) low in task involvement, collaborative involvement, and conflict (Indifferent), (3) high in task involvement and conflict, low in collaborative involvement (Inharmonious). The Harmonious group demonstrated the best adherence, glycemic control, and psychosocial well-being. The Inharmonious and Indifferent groups had similar diabetes management, but youth from Inharmonious families showed poorer psychosocial well-being. The intervention effect on glycemic control did not differ across the classes.

Conclusions: The interplay of parental involvement and conflict resulted in distinct parenting classes that differed in disease management and well-being. However, the classes benefitted similarly from the behavioral intervention.

Keywords

juvenile-onset diabetes; parent–child relationship; self-management; type 1 diabetes

1 | INTRODUCTION

Management of type 1 diabetes typically deteriorates during adolescence, increasing the risk of short- and long-term complications.[1,2] Most youth with type 1 diabetes do not meet target glycemic control targets,[3] and older children and adolescents are at particular risk of poor regimen adherence and glycemic control due to both physiological and developmental changes.[4] Growth hormone, which increases during puberty, is antagonistic to insulin,[5,6] leading to more difficulty controlling glucose levels during late childhood and adolescence. Concurrently, the normative increase in autonomy-seeking during this developmental stage often leads to greater parent–child conflict[7] and poorer regimen adherence. As such, understanding how parent–child relationships may influence youth diabetes management is critical during this developmental period.

Lower parent–child conflict[8–10] regarding diabetes management and a more supportive or collaborative style of parent involvement[11–13] are associated with better adherence, glycemic control, and well-being. Findings regarding parent task involvement are mixed, with some studies showing positive associations with diabetes management,[14,15] and others showing no association.[16,17] Higher parent task involvement during adolescence may help ensure that the diabetes regimen is implemented properly; however, it may also provide additional opportunities for parent–child conflict around diabetes management. Therefore, examining the pattern of responses across multiple dimensions of parent involvement may yield a more nuanced understanding of the relations between parent–child relationships and diabetes management than examining each construct individually. While some research has examined how general parenting styles are related to youth outcomes,[18–20] no research has examined how patterns across diabetes-related parental involvement constructs are associated with youth diabetes management and well-being.

This study examined patterns of diabetes-specific parenting behaviors, including dimensions of parental involvement and parent–youth conflict, in a sample of parent–youth dyads enrolled in a family-based behavioral intervention. We sought to: (1) identify classes based on parent and child reports of parent task involvement, collaborative involvement, and parent–youth conflict; (2) examine relations of these classes with youth baseline glycemic control, regimen adherence, quality of life, and depressive symptoms; and (3) examine whether the intervention effect on glycemic control differed between the identified classes and whether the intervention affected diabetes-specific parenting behaviors.

2 | METHODS

2.1 | Design

The data for this secondary analysis come from the Family Management of Diabetes clinical trial conducted from 2006 to 2009. This multi-site, parallel-group trial tested the efficacy of a clinic-integrated, family-based behavioral intervention for families of youth with type 1 diabetes. Participants were enrolled from four large, geographically diverse pediatric endocrinology centers in the United States (Boston, MA; Chicago, IL; Jacksonville, FL; Houston, TX).

2.2 | Participants

Eligible families were those with a child between 9 and 14.9 years of age who was diagnosed with type 1 diabetes for at least 3 months; glycated hemoglobin (HbA1c) between 6% (42 mmol/mol) and 12% (108 mmol/mol) for those diagnosed <1 year or greater than 6% (42 mmol/mol) for those diagnosed >1 year; daily insulin dosage of 0.5 μg/kg/day for those diagnosed for ≥1 year or 0.2 μg/kg/day for those diagnosed for <1 year, with ≥2 injections or units of insulin pump; and not affected by any other major chronic disease (with the exception of well-controlled asthma, celiac, or thyroid disease) or serious cognitive/psychiatric disorder. Parent and family inclusion criteria included fluency in English, telephone access, attendance to at least two clinic visits in the past year, and no psychiatric diagnoses in participating parents. The sample size was determined through the estimation of detecting significant differences in HbA1c levels between treatment and usual care at a given time point, as described previously.[21]

2.3 | Procedures

Families were recruited during routine clinic visits and followed for 2 years. Parents provided informed written consent and youth provided written assent. Baseline assessments were conducted in participant homes (or other convenient location if preferred by participants) by a data coordinating center, who were blinded to study assignment and not affiliated with the clinical sites. Clinic study assessments were conducted by members of the research team. The study protocol was approved by the institutional review board of each clinical site and the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development.

2.4 | Treatment groups

Participating families were randomized to usual care or intervention following the baseline assessment; randomization procedures have been described previously.[21] Randomization was stratified by age (9–<12 and 12–<15 years) and HbA1c [≤8.3% (67 mmol/mol) and >8.3% (67 mmol/mol)]. Research staff provided usual care families with clinical liaison support, including assistance with appointment-scheduling. The intervention group participated in family sessions with a trained research assistant at each clinic visit. The "WE-CAN" manage diabetes intervention was designed to improve adherence and family management practices across the developmental period of pre- and early adolescence. Family sessions were structured around an applied problem-solving approach —a semi-structured process incorporating assessment and specification of target behaviors, identification of barriers and motivators, collaborative setting of goals, facilitation of problem-solving and coping skills, and provision of follow-up and support. Supplementary materials addressed common family issues including communication, conflict, and responsibility-sharing. A detailed description of the intervention has been published previously.[21]

2.5 | Measures

This study utilized self-report data from youths and one parent (89.6% mothers) and biospecimens from youth. All measures used are from the baseline assessment with the exception of HbA1c and parenting constructs, for which values are examined at both baseline and 2-year follow-up.

2.5.1 | Parent collaborative involvement—Youth completed the 16-item Collaborative Parent Involvement Scale. This measure assesses aspects of parent involvement that reflect a collaborative role in diabetes management, such as consulting, supporting, planning, problem-solving, and troubleshooting. Items include assisting with planning diabetes care to fit the youth's schedule, helping the youth learn how to manage difficulties with diabetes, knowing when to give the youth more autonomy, and knowing when the youth requires assistance. Response options range from *almost never* [1] to *always* [5]. Higher average scores indicate greater collaborative involvement. The measure has previously shown good internal consistency, expected age-related changes, and differential relationships with adherence.[22] Cronbach alpha (α) was 0.93.

2.5.2 | Diabetes-related conflict—The revised Diabetes Family Conflict Scale, completed by youth and parents, queries family conflict around 19 aspects of diabetes management such as arguing about remembering to check blood sugars.[23] Response options are on a 3-point scale, from *never argue* [1] to *always argue* [3]. Higher average scores indicate greater conflict ($\alpha_{\text{child}} = 0.92$; $\alpha_{\text{parent}} = 0.89$). Both youth (Mean(*SD*) = 27.32(7.95), Skew = 1.48) and parent (Mean(*SD*) = 28.24(6.08), Skew = 2.11) scores were logarithmically transformed due to skewness.

2.5.3 | Parent task involvement—The Diabetes Family Responsibility Questionnaire, completed by youth and parents, assesses the degree of parent involvement in 17 diabetes management tasks, such as taking insulin, adjusting insulin, deciding what to eat, and

remembering to do blood sugar checks.[24] For each item, participants indicate whether responsibility for the task belongs to the child [1], is shared equally between child and parent [2], or belongs to the parent [3]. The sum of the items indicates overall parent involvement in diabetes management tasks (α_{child} = 0.69; α_{parent} = 0.73).

2.5.4 | Quality of life—The PedsQL Generic Core Scales[25] and PedsQL Diabetes Module[26] were completed by youth. The measures have well-established validity in healthy and patient populations including youth with diabetes.[25,26] Scores on the Generic Core Scales reliably differentiate between healthy children and those with acute or chronic conditions, are related to indicators of morbidity and illness burden, and display a factor-derived solution consistent with a priori conceptually driven scales. Response options are on a five-point scale, from *never a problem* [0] to *a lot of a problem* [4]. Higher scores indicate better general quality of life (PedsQL Generic Core Scales; α = 0.90) and diabetes quality of life (PedsQL Diabetes Module; α = 0.87).

2.5.5 | Depressive symptoms—Youth completed the Children's Depression Inventory (CDI[27]), a 27-item measure validated in children aged 7–17 years.[28] Responses for the 27 depressive symptoms are rated from *no symptom* [0] to *distinct sym*ptom [2], with response options specific to each symptom. CDI summed scores range from 0 to 54; higher scores indicate greater depressive symptoms (α= 0.89).

2.5.6 | Glycemic control—Blood samples were collected for HbA1c assay (Tosoh A1c 2.2 Plus Glycohemoglobin Analyzer, Tosoh Medics, South San Francisco, CA) at a centralized laboratory (Joslin Diabetes Center, Boston, MA). Samples were also processed with the DCA-2000 (Siemens Healthcare Diagnostics, Deerfield, IL) onsite and used to impute replacement values for lost or damaged samples (1.2% of values). Higher scores indicate poorer glycemic control.

2.5.7 | Adherence—Diabetes management adherence was assessed with the Diabetes Self-Management Profile, a well-validated structured interview conducted with parents.[29,30] The interview assesses overall adherence to a diabetes management regimen in the past 3 months across five domains: diet, exercise, blood glucose testing, insulin administration, and management of low blood sugar. Parallel versions are used for youth on flexible and conventional regimens. Higher scores indicate greater adherence.

2.5.8 | Demographics—Participant characteristics including age, gender, family composition, income, education, race/ethnicity were collected from the electronic medical record or reported by parents.

2.6 | Analyses

All analyses were conducted using R statistical software.[31] Latent profile analysis using the FlexMix package[32] was conducted with baseline measures of diabetes-specific parenting behaviors to identify potential subgroups. Latent profile analysis is an exploratory approach that identifies subgroups based on participants' observed responses to a set of variables.[33] This analytic strategy clusters individuals with similar response patterns across a set of

variables into distinct classes. The variables included were baseline youth-reported parent task involvement, parent–child conflict, and collaborative involvement, and parent-reported parent task involvement and parent–child conflict. Five models in total were estimated. The first model estimated a single class, and each model following estimated an additional latent class. The best fitting model was determined by examining the AIC,[34] BIC,[35] and ICL[36] values of each model, with lower values indicating better model fit than the previously estimated model. Additionally, we examined each model's entropy values,[37] which indicate how distinct each estimated class is from the other estimated classes in a model, and the significance of the bootstrap likelihood ratio tests (BLRT[38]), which indicate whether an estimated model is better at explaining the data than the previously estimated model. Criteria for the best fitting model were that the AIC, BIC, and ICL values no longer decreased meaningfully as the number of classes estimated increased, the entropy value was greater than 0.70, and the BLRT *p*-value was no longer significant at the 0.05 level. The model that best meets these cutoff criteria has adequately distinct classes that present an acceptable representation of the data utilized to create the classes. Additionally, we considered how well each model produced distinct and meaningful classes.[39] Complete baseline data were available on youth-reported constructs, while data on parent-reported constructs (parent task involvement and diabetes-related conflict) were missing in six families. We generated multiple imputations for these incomplete constructs by Gibbs sampling, using multivariate imputation by chained equations as implemented in the R "mice" package.[40]

Next, we examined whether the classes differed in baseline glycemic control (HbA1c), regimen adherence, diabetes quality of life, general quality of life, and depressive symptoms using ANCOVA. Each model included the parenting classes estimated from the latent profile analyses as the independent variable, one outcome, and was adjusted by youth sex and race/ethnicity. To determine whether the intervention effect on glycemic control (HbA1c) differed between the parenting classes, a factorial ANCOVA examined the interaction between intervention group and latent classes on the change in HbA1c from baseline to 2-year follow-up, controlling for youth sex and race/ethnicity. Significant main effects for the ANCOVA and factorial ANCOVA analyses were probed using Tukey's HSD multiple comparisons. Tukey's HSD multiple comparisons is a post-hoc test used to determine if individual pairwise comparisons within a factorial ANCOVA analysis are significantly different from one another.[41] A *p*-value of less than 0.05 indicates that mean for one group is significantly different from the mean of the other group in the pairwise comparison. Additionally, we tested the intervention effect at 2-year follow-upon each of the diabetes-specific parenting constructs (task involvement, collaborative involvement, conflict) using the same approach. Across the ANCOVA models, 22–28 families had missing data on outcomes or covariates. This missingness was handled using a maximum likelihood approach.

3 | RESULTS

Descriptive statistics and bivariate correlations of all study variables are presented in Tables 1 and 2. The sample consisted of 75.0% white youth (50.8% female) with a mean age of 12.43 ± 1.72 years; onethird used an insulin pump. At baseline, youth on average reported high parental task involvement [Mean (*SD*) = 33.37 (4.36)], high collaborative involvement

[Mean (*SD*) = 4.18 (0.82)], and moderate levels of parent–child conflict [Mean (*SD*) = 1.42 (0.11)]. Parents also reported high task involvement [Mean (*SD*) = 37.28 (4.59)] and moderate levels of parent–child conflict [Mean (*SD*) = 1.41 (0.09)]. No study-related adverse events were reported.

3.1 | Identifying and describing the latent classes

Fit indices from the models estimating one through five classes suggested a three- or four-class solution (Table 3). The ICL value and BLRT tests indicated a three-class solution, but the AIC and BIC values indicated a four-class solution. Thus, we examined both models and determined that the three-class solution produced the most meaningful and distinct classes.

The mean values for each diabetes-specific parenting behavior variable across the three latent classes are presented in Table 4. Class 1 demonstrated high parent task involvement, low parent–youth conflict, and high collaborative involvement, and was labeled as the "Harmonious" class. Class 2 demonstrated low task involvement, collaborative involvement and conflict. Because of the low levels of both involvement and conflict, Class 2 was labeled as the "Indifferent" class. Class 3 demonstrated high task involvement (similar to Class 1), the highest parent–youth conflict, and low collaborative involvement. This group was labeled as the "Inharmonious" class to reflect the high levels of reported task involvement and conflict.

3.2 | Differences between parenting classes in diabetes management, quality of life, and depressive symptoms at baseline

The classes differed significantly in HbA1c [$F(2, 357) = 7.43$, $p < 0.01$], regimen adherence [$F(2, 363) = 13.42$, $p < 0.01$], overall quality of life [$F(2, 363) = 19.63$, $p < 0.01$], diabetes quality of life [$F(2, 363) = 29.53$, $p < 0.01$], and depressive symptoms [$F(2, 361) = 18.43$, $p < 0.01$], controlling for youth age and race/ethnicity (Table 5). Youth sex and parent education and income were not associated with class membership (data not shown). The Harmonious class fared best across all outcomes, demonstrating better glycemic control (i.e., lower HbA1c) and regimen adherence, greater general and diabetes quality of life, and fewer depressive symptoms. The Inharmonious class had worse glycemic control (i.e., higher HbA1c) and regimen adherence, lower general and diabetes quality of life, and more depressive symptoms than the Harmonious class. The Indifferent class fell between the Harmonious and Inharmonious classes across the outcomes, reporting general and diabetes quality of life similar to the Harmonious class, but also reporting poorer regimen adherence and more depressive symptoms. The Indifferent class did not differ from either the Harmonious or Inharmonious classes in glycemic control (HbA1c).

3.3 | Does the intervention effect on glycemic control (HbA1c) differ between parenting classes?

Overall, the intervention group demonstrated a smaller increase in HbA1c [Mean (*SE*) = 0.45 (0.11)% (4.9 [1.2] mmol/mol)] from baseline to 2-year follow-up than the usual care group [Mean (*SE*) = 0.79 (0.12)% (8.6 [1.3] mmol/mol)] [$F(1, 313) = 4.81$, $p = 0.03$], controlling for youth age and race/ethnicity. However, parenting class was not significantly associated with change in HbA1c [$F(2, 313) = 1.87$, $p = 0.16$], and the interaction between

parenting class and intervention was not statistically significant [F (2, 313) = 0.23, $p = 0.80$]. Additionally, there was no intervention effect on parental task involvement [$F_{\text{parent-report}}$ (1, 360) = 0.00, $p = 0.98$; $F_{\text{youth-report}}$ (1, 360) = 1.19, $p = 0.28$], collaborative involvement [F (1, 360) = 1.31, $p = 0.25$], and parent–youth conflict [$F_{\text{parent-report}}$ (1, 360) = 0.50, $p = 0.48$; $F_{\text{youth-report}}$ (1, 360) = 0.93, $p = 0.34$].

4 | DISCUSSION

In this clinical trial of 390 youth with type 1 diabetes and their parents, distinct classes emerged representing patterns across dimensions of diabetes-specific parenting constructs. The Harmonious class—those high in task and collaborative involvement and low in parent–youth conflict—fared best across all diabetes management and psychosocial indicators. Both the Indifferent class (low in task and collaborative involvement and conflict) and the Inharmonious class (high in task involvement and conflict and low in collaborative involvement) demonstrated poorer regimen adherence and glycemic control than the Harmonious class. However, the Indifferent class reported better general and diabetes quality of life and fewer depressive symptoms than the Inharmonious class. Notably, however, there was no intervention effect on the parenting constructs, nor was there a significant interaction of parenting class membership with intervention status on the change in glycemic control across 2 years. Together with findings of an overall beneficial effect of the intervention on glycemic control findings suggest that the intervention was effective across all parenting classes despite having no influence on diabetes-related parenting behaviors.

Findings are consistent with previous research that indicates greater parental collaborative[11–13] and task involvement[14,15] and lower parent–youth conflict[8–10] are associated with more optimal diabetes management outcomes. However, differences between parenting classes suggest the importance of examining patterns across these constructs. Both the Indifferent and Inharmonious classes demonstrated a combination of optimal and poorer scores across the diabetes-specific parenting constructs. Those with high task involvement but low collaborative involvement and high parent–youth conflict (Inharmonious) demonstrated worse quality of life and greater depressive symptoms than those with low task and collaborative involvement but low conflict (Indifferent). Thus, findings suggest that it may be critical to ensure effective management of conflict and a collaborative parent–child relationship before promoting greater parental task involvement.

The utility of examining patterns across parenting constructs is also reflected in the research on general parenting style. An authoritative parenting style (characterized by high responsiveness and high demandingness) is associated with more optimal youth psychosocial development than authoritarian (low responsiveness and high demandingness) and permissive (high responsiveness and low demandingness) styles.[42] In youth with type 1 diabetes, authoritative parenting is associated with better glycemic control, whereas authoritarian and permissive parenting are associated with worse control; however, these studies did not directly compare parenting style classifications.[18–20] An examination of classifications of family functioning derived from general parenting measures and diabetes-related conflict found that youth from families with cohesive family relationships and low conflict demonstrated better diabetes management outcomes than those with less cohesive

family relationships and/or higher or incongruent reports of conflict.[43] Our study is the first to examine parenting classes based on diabetes management-specific parental involvement behaviors, finding unique differences according to the interplay of parent involvement and conflict. While the parenting classes examined here differ from general parenting style classifications, future research examining the congruence of parenting style and diabetes-related parenting may be informative. The complex and demanding nature of diabetes management creates unique challenges for parents as they navigate providing necessary assistance and problem-solving in disease management while minimizing intrusiveness and conflict. Parents' diabetes-specific parenting behaviors are informed by their general parenting style; as such, the classes observed herein may reflect an operationalization of parenting style applied to disease management.

Despite the differences between classes in the pattern of parent involvement and conflict, the beneficial intervention effect on glycemic control did not differ between classes. Given the absence of intervention effects on parent involvement and conflict, the findings suggest the potential to improve diabetes management even in families where parent–child relationships are less than optimal. These findings could indicate that the flexible nature of the "WE-CAN" manage diabetes intervention may have allowed for families with diverse parent–child relationship structures to all benefit from the intervention, even if the intervention did not impact diabetes-specific parenting behaviors or parent–child conflict. Future research may examine whether interventions tailored to diverse parent–child relationships are more effective than use of a singular approach.

Study findings should be interpreted in light of its strengths and limitations. This study included a socioeconomically diverse sample of parent–child dyads from four large, geographically-diverse urban areas. Although the diabetes-specific parenting measures were self-reported, classifying families based on both parent and youth reports minimizes bias that may be found when examining only parent or youth reports. While this US sample consisted of 25% of families that self-identified as ethnic minorities, the majority white sample precludes the ability to examine differences in classes by race/ethnicity. Additionally, this study was conducted from 2006 to 2009; diabetes management has continued to evolve since that time, with increased use of insulin pumps and continuous glucose monitoring. Advances in technology may impact parent–child dynamics and specific tasks for which parents are involved; examination of parenting classes in a more contemporary sample would be informative. Nevertheless, onethird of the current sample did use insulin pumps, and many of the challenges inherent to family management of diabetes, such as negotiating responsibility, managing conflict, and dealing with blood glucose excursions, are common to all diabetes regimens.

5 | CONCLUSION

Findings from this study of 390 US youth with type 1 diabetes and their parents indicate that examining patterns of parental involvement and conflict in diabetes management provides unique information about their associations with youth diabetes and psychosocial outcomes. Notably, youth in families with high task involvement and high conflict (Inharmonious) fared worse overall than those in families with low task involvement and low conflict

(Indifferent). Findings indicate detrimental effects of frequent parent–child conflict, even in families with high parental involvement in diabetes management tasks. The results suggest the need for future research to consider the interplay of these dimensions of parental involvement in disease management as they relate to youth health and well-being. Additionally, future research can examine how parental task and collaborative involvement and parent–youth conflict apply to the management of other chronic diseases and conditions.

FUNDING INFORMATION

This research was supported by the intramural research program of the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (NICHD), contract #'s N01-HD-3–3360, N01-HD-4–3361, N01-HD-4–3362, N01-HD-4–3363, N01-HD-4–3364.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in ClinicalTrials.gov at https://clinicaltrials.gov/, reference number NCT00273286.

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TABLE 1

Descriptive statistics of study variables

		n (%)
Intervention Group	Usual Care	189 (48.46)
	Intervention	201 (51.54)
Youth Sex	Male	192 (49.23)
	Female	198 (50.76)
Youth Ethnicity	White	276 (75.00)
	Non-White	92 (25.00)
Parent Education	High School/GED or Less	49 (12.56)
	Some College or Technical School	113 (28.97)
	College Graduate	180 (46.15)
	Professional School	48 (12.31)
Parent Income	Under $20,000	23 (6.55)
	$20,000 to 29,999	17 (4.84)
	$30,000 to 39,999	22 (6.27)
	$40,000 to 49,999	25 (7.12)
	$50,000 to 69,999	54 (15.38)
	$70,000 to 99,999	84 (23.93)
	$100,000 to 149,999	71 (20.23)
	$150,000 or More	55 (15.67)
Insulin Pump Usage	Yes	131 (33.76)
	No	267 (66.24)
		Mean (SD)
Youth Age		12.43 (1.72)
Youth Reported Parent Task Involvement		33.37 (4.36)
Youth Reported Parent-Youth Conflict[a]		1.42 (.11)
Youth Reported Collaborative Involvement		4.18 (.82)
Parent Reported Parent Task Involvement		37.28 (4.59)
Parent Reported Parent-Youth Conflict [a]		1.41 (.09)
Baseline HbA1c		8.36 (1.15)%
		68 (12.6) mmol/mol
2-year HbA1c		8.94 (1.41)%
		74 (15.4) mmol/mol
Regimen Adherence		61.49 (9.56)
General Quality of Life		79.58 (13.08)
Diabetes Quality of Life		70.10 (12.46)
Depressive Symptoms		5.94 (6.60)

[a]Both measures of parent–youth conflict are log-transformed.

TABLE 2

Bivariate correlations between all study variables at baseline

Demographics[a]	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
1. Intervention Group[b]	0.00	−0.01	0.08	−0.03	0.02	0.03	−0.07	−0.11*	0.04	−0.12*	0.05	0.03	0.07	0.03	0.04	−0.02
2. Youth Sex[c]	-	0.06	0.01	−0.12*	−0.01	−0.11*	0.09	−0.08	0.14**	−0.01	0.01	−0.05	0.05	0.01	−0.02	−0.04
3. Youth Race/ Ethnicity[d]	-	-	−0.22**	−0.42**	−0.24**	0.00	0.06	0.29**	−0.12*	0.16**	0.34**	0.18**	−0.17**	−0.20**	−0.26**	0.12*
4. Parent Education	-	-	-	0.38**	0.14**	−0.12*	−0.02	−0.11*	0.02	−0.04	−0.15**	−0.12*	0.05	0.09	0.09	−0.01
5. Parent Income	-	-	-	-	0.23**	−0.06	−0.08	−0.21**	0.13*	−0.20**	−0.42**	−0.18**	0.18**	0.22**	0.29**	−0.15**
6. Insulin Pump Usage[e]	-	-	-	-	-	0.03	−0.08	−0.11*	0.04	−0.25**	−0.08	−0.11*	0.09	0.09	0.14**	−0.11*
7. Youth Age	-	-	-	-	-	-	−0.48**	0.00	−0.22**	−0.47**	0.21**	0.18**	−0.25**	0.09	0.03	0.08
Youth Report																
8. Parent task involvement	-	-	-	-	-	-	-	0.09	0.19**	0.48**	0.03	−0.13*	0.14**	−0.17**	−0.17**	0.01
9. Parent-youth conflict[f]	-	-	-	-	-	-	-	-	−0.20**	0.13*	0.26**	0.19**	−0.18**	−0.38**	−0.43**	0.30**
10. Collaborative involvement	-	-	-	-	-	-	-	-	-	0.09	−0.21**	−0.21**	0.33**	0.27**	0.32**	−0.47**
Parent Report																
11. Parent task involvement	-	-	-	-	-	-	-	-	-	-	0.12*	0.02	0.00	−0.13*	−0.12*	0.04
12. Parent-youth conflict[f]	-	-	-	-	-	-	-	-	-	-	-	0.29**	−0.33**	−0.22**	−0.30**	0.20**
Youth diabetes management indicators																
13. HbAlc	-	-	-	-	-	-	-	-	-	-	-	-	−0.37**	−0.11*	−0.13*	0.11*
14. Regimen adherence	-	-	-	-	-	-	-	-	-	-	-	-	-	0.19**	0.25**	−0.27**
Youth psychosocial indicators[a]																
15. General quality of life	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.73**	−0.62**
16. Diabetes quality of life	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	−0.53**
17. Depressive symptoms	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[a]Reported at baseline.

[b]1 = intervention, 0 = control.

[C]1 = male, 0 = female.

[d]0 = White, 1 = non-White.

[e]1 = yes, 0 = no.

[f]Both measures of parent-youth conflict are log-transformed.

* $p < 0.05$,

** $p < 0.01$.

TABLE 3

Model selection results in latent profile analysis of baseline diabetes-specific parenting behaviors management parental involvement

	1-Class	2-Class	3-Class	4-Class	5-Class
AIC	4119.41	3827.97	2691.28	3626.46	3724.53
BIC	4159.07	3911.26	3818.19	3797.00	3895.07
ICL	4159.07	3973.40	3934.59	3944.42	3991.78
Entropy	–	0.76	0.72	0.71	0.79
BLRT *p* value	0.02	0.02	0.74	0.84	0.83

Abbreviations: AIC, Akaika Information Criterion; BIC, Bayesian Information Criterion; BLRT, Bootstrap Likelihood Ratio Test; ICL, Integrated Completed Likelihood.

TABLE 4

Characteristics of the three estimated parenting classes

	Class 1: Harmonious *n* = 142 (36.4%)		Class 2: Indifferent *n* = 108 (27.7%)		Class 3: Inharmonious *n* = 140 (35.9%)				
	Mean (*SD*)	**Range**	**Mean (*SD*)**	**Range**	**Mean (*SD*)**	**Range**	**Tukey's HSD Multiple Comparisons**		
Youth report									
Parent task involvement	34.64 (3.45)	34.07–35.21	29.51 (3.18)	28.90–30.12	35.07 (4.15)	34.78–35.76	1 > 2	1 = 3	2 < 3
Parent-youth conflict	1.35 (0.05)	1.35–1.36	1.38 (0.06)	1.37–1.39	1.52 (0.12)	1.50–1.54	1 < 2	1 < 3	2 < 3
Collaborative involvement	4.82 (0.18)	4.79–4.85	3.73 (0.80)	3.57–3.88	3.89 (0.83)	3.75–4.03	1 >2	1 > 3	2 = 3
Parent report									
Parent task involvement	38.30 (3.40)	37.73–38.63	32.92 (3.33)	32.29–33.56	39.62 (4.18)	38.92–40.32	1 < 2	1 > 3	2 < 3
Parent-youth conflict	1.38 (0.06)	1.37–1.39	1.39 (0.07)	1.38–1.41	1.46 (0.07)	1.44–1.47	1 < 2	1 = 3	2 < 3

Notes: Both measures of parent-youth conflict are log-transformed.

TABLE 5

ANCOVA analyses examining differences between the estimated parenting classes in indicators of diabetes management and psychosocial well-being at baseline

	Class 1: Harmonious *n* = 142 (36.4%)		**Class 2: Indifferent *n* = 108 (27.7%)**		**Class 3: Inharmonious *n* = 140 (35.9%)**				
	Mean (*SE*)	**Range**	**Mean (*SE*)**	**Range**	**Mean (*SE*)**	**Range**	**Tukey's HSD Multiple Comparisons**		
Glycemic Control	*8.19(0.11)%* 66 (1.2) mmol/mol	*7.79–8.41* 62–68	*8.37(0.13)%* 68 (1.4) mmol/mol	*8.12–8.62* 65–71	*8.73 (0.10)%* 72 (1.1) mmol/mol	8.54–8.93 70–74	1 = 2	1 < 3	2 = 3
Regimen Adherence	64.06 (0.88)	62.33–65.78	59.15 (0.99)	57.21–61.09	58.68 (0.78)	57.13–60.22	1 > 2	1 > 3	2 = 3
General Quality of Life	83.33 (1.18)	81.02–85.65	80.03 (1.33)	77.42–82.63	73.95 (1.05)	71.88–76.02	1 = 2	1 > 3	2 > 3
Diabetes Quality of Life	73.21 (1.11)	71.02–75.40	70.78 (1.25)	68.31–73.24	62.59 (1.00)	60.63–64.55	1 = 2	1 > 3	2 > 3
Depressive Symptoms	3.68 (0.63)	2.44–4.91	6.11 (0.70)	4.73–7.50	8.57 (0.56)	7.47–9.67	1 < 2	1 < 3	2 < 3

Notes: Youth age and race/ethnicity are included as covariates.