

RESEARCH ARTICLE

Quality of life among youth with poorly controlled Type 1 diabetes: role of family conflict and sharing of treatment responsibility

Melissa Cousino*¹, Rebecca Hazen^{2,3}, Sarah MacLeish^{2,4},
Rose Gubitosi-Klug^{2,4} & Leona Cuttler^{2,4}



Practice Points

- Current treatment for youth with Type 1 diabetes mellitus (T1DM) not only focuses on reaching metabolic goals, but also on fostering a good quality of life (QoL).
- Youth reporting a significant negative impact of diabetes on their QoL are less likely to reach treatment goals.
- Interactive models examining family factors related to diabetes management may be important in understanding QoL for youth with poor metabolic control to determine modifiable clinical intervention targets; thus, this study aimed to test a model examining the interactions of diabetes-specific family conflict and parent–adolescent sharing of treatment responsibility for T1DM management in predicting youth QoL.
- Participants included 72 youth with poor metabolic control ($\geq 8.5\%$ HbA1c) who were aged between 10 and 18 years and had T1DM for ≥ 12 months.
- Youth and parents completed questionnaire-based measures assessing diabetes-specific youth QoL, regimen adherence, family sharing of treatment responsibility and diabetes-specific family conflict.
- Youth report of shared treatment responsibility was associated with a reduced impact of diabetes on youth QoL.
- The combination of lower levels of shared treatment responsibility and higher levels of family conflict were associated with a negative impact of diabetes on youth QoL.
- Interventions that target and promote parent–adolescent sharing of treatment responsibility, even among families experiencing diabetes-related conflict, may help to foster better youth QoL.

¹Department of Psychological Sciences, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH 44106, USA

²Department of Pediatrics, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH 44106, USA

³Division of Developmental/Behavioral Pediatrics & Psychology, Rainbow Babies & Children's Hospital, 11100 Euclid Avenue, Cleveland, OH 44106, USA

⁴Division of Pediatric Endocrinology, Diabetes & Metabolism, Rainbow Babies & Children's Hospital, 11100 Euclid Avenue, Cleveland, OH 44106, USA

*Author for correspondence: Tel.: +1 216 368 3131; Fax: +1 216 368 4891; melissa.cousino@case.edu

SUMMARY **Aims:** In addition to maintaining metabolic goals, treatment for youth with Type 1 diabetes mellitus emphasizes the importance of fostering a good quality of life (QoL). This study examines the roles of diabetes-specific family conflict and family sharing of treatment responsibility on the QoL of youth with poor metabolic control. **Patients & methods:** Youth ($n = 72$) aged 10–18 years with Type 1 diabetes mellitus for ≥ 12 months and poor metabolic control (recent HbA1c $\geq 8.5\%/69$ mmol/mol) and their parents completed questionnaires assessing diabetes-specific youth QoL, regimen adherence, family sharing of treatment responsibility, and diabetes-specific family conflict. **Results:** Lower levels of shared treatment responsibility and higher levels of family conflict around diabetes-related issues interacted to predict poorer diabetes-specific QoL. **Conclusion:** It is important for youth and parents to share the burden of diabetes care, even when families are experiencing diabetes-specific conflict. Interventions aimed at helping families problem-solve ways to share treatment responsibility may enhance youth QoL.

One of the most common chronic diseases of childhood, Type 1 diabetes mellitus (T1DM), requires intensive daily disease management that includes multiple blood glucose checks, insulin injections or pump therapy, dietary monitoring, and regular exercise. Treatment regimen adherence and good metabolic control are important for medical and psychological health in youth with T1DM [1]. Health-related quality of life (HRQoL), defined as the impact of illness and treatment on one's physical, psychological and social functioning [2], has become increasingly important to healthcare delivery, and medical and psychological interventions [3,4]. In youth with T1DM, HRQoL is central to treatment [5] as it relates to metabolic control [6,7] and treatment adherence [8].

Given the importance of quality of life (QoL), researchers have investigated family factors as possible correlates of QoL. Parental involvement in T1DM care has been found to be associated with better child health and psychosocial outcomes [5,9–11]. Thus, the American Diabetes Association recommends continued parental involvement in care [1], and interventions have been designed to encourage a teamwork approach to T1DM management between parents and youth [11]. Recent research has highlighted the benefits of youth and parents sharing the responsibility for treatment-related tasks [9], such as remembering to check blood sugar. However, studies exploring the relationship between HRQoL, QoL and parental involvement have yielded inconsistent findings. Some have reported a significant association between HRQoL and parental involvement [12], while others have failed to find a relationship between QoL and parental involvement [13,14] and HRQoL and parental involvement [14]. Variations in measurements and sample characteristics may explain some of the inconsistencies.

Alternatively, an unaccounted for moderating variable, such as family conflict, may advance our understanding of the relationship between youth QoL and family allocation of responsibility for diabetes-related tasks.

Diabetes-specific family conflict, a modifiable family factor, as demonstrated by intervention studies [11,15,16], has been found to be associated with youth HRQoL [14,16]. Thus, family conflict and parental involvement in care are considered to be two important variables for promoting positive outcomes in youth with T1DM [11]. Although researchers have examined independent associations between parental involvement in T1DM management and diabetes-specific family conflict with youth HRQoL/QoL, an interactive model has not been tested. To our knowledge, this is the first study to examine the interactive effects of family sharing of treatment responsibility and diabetes-specific family conflict in predicting diabetes-specific youth QoL, an illness-specific form of HRQoL. The current study's emphasis on family sharing the treatment responsibility is also of significance. The underinvolvement or overcontrol of parents may contribute to negative psychosocial and health outcomes, such as reduced youth QoL and poorer adherence [8]; thus, shared treatment responsibility is recommended, even in adolescence [1].

The interactive model was tested in youth with poor metabolic control, a population at risk of medical and psychological problems [1]. This research is consistent with the Self and Family Management Theoretical Framework [17], which posits that illness management takes place within the family context, and that modifiable risk and protective factors – such as family functioning and support – can be directly targeted for intervention. It was hypothesized that higher levels of shared treatment responsibility in combination

with lower levels of diabetes-specific family conflict would be associated with better youth diabetes-specific QoL after controlling for youth adherence, emotional distress and HbA1c.

Patients & methods

Subjects

The current cross-sectional research study was part of a larger institutional review board-approved clinic-based intervention study to improve metabolic outcomes at an urban, university-affiliated children's hospital in youth aged 10–18 years who had T1DM for ≥ 12 months and a baseline HbA1c of $\geq 8.5\%$ (69 mmol/mol) at recruitment. The current study utilized baseline data from patients who completed prandomization into a larger intervention study that involved three study arms: standard care; four monthly intensive clinic visits (e.g., psychological intervention, diabetes education and endocrine care); and four monthly intensive clinic visits and continuous glucose monitoring. Responses to baseline questionnaires used in the current study did not affect randomization or participation in the intervention study. Non-English-speaking participants, those who had received previous psychological services to address adherence issues, participants not living with a legal guardian, and those with comorbid conditions that prevented them from taking part in their own diabetes management were excluded ($n = 21$). One hundred and eighty eight participants were contacted and eligible for the larger study, and a total of 72 youth participated in the current study. Lack of interest and time intensiveness of the intervention study were common reasons for refusal to participate in the larger study ($n = 95$). Informed consent and assent were obtained from participants. The youth and one parent/caregiver completed the questionnaires used for the current investigation in a single visit to the pediatric outpatient endocrinology clinic. Serum HbA1c testing was conducted at this visit as a measure of metabolic control.

Measures

Background information questionnaire

Parents provided information regarding family demographics, family income, parent educational history and youth T1DM history.

Diabetes Family Responsibility Questionnaire

The Diabetes Family Responsibility Questionnaire (DFRQ) is a 17-item measure, completed separately by the child and parent, to assess who

takes responsibility for treatment-related tasks [18]. Frequency counts were computed for child responsibility, equal (shared) responsibility and parent responsibility, a scoring method recently used by others [9]. The shared responsibility score was used for regression analyses due to the importance of shared treatment responsibility for health and psychosocial outcomes [1,9,11]. Cronbach's α coefficients for shared treatment responsibility were good for both youth (0.80) and parent (0.84) reports in the current study. Support for the construct validity of this measure has been demonstrated in previous research [18].

Diabetes Family Conflict Scale – Revised

The 19-item Diabetes Family Conflict Scale – Revised (DFCS-R) total score was used to assess family conflict as reported by both the youth and parent [19]. Evidence of high internal consistency for this scale has been reported [19], and high internal consistencies for youth ($\alpha = 0.94$) and parent ($\alpha = 0.84$) versions were demonstrated in the current study.

Diabetes Quality of Life Questionnaire – Youth

The 23-item youth-completed Disease Impact scale of the Diabetes Quality of Life Questionnaire – Youth (DQoLY) was used to measure how often diabetes negatively impacts the child physically, psychologically and socially [20]. Due to high intercorrelation of the Disease Impact scale with the DQoLY subscales, researchers have used this subscale in regression analyses [21]. Higher scores indicate poorer diabetes-specific QoL. High internal consistency for the Disease Impact scale has been reported [20] and was also demonstrated in the current study ($\alpha = 0.83$).

Self Care Inventory – Revised

The 14-item youth-completed Self Care Inventory – Revised (SCI-R) total score was used as a measure of youth T1DM adherence in the past month [22]. High internal consistency, concurrent validity and construct validity have been reported for this scale [23,24]. The Cronbach's α coefficient for the current study was 0.80.

Positive & Negative Affect Schedule for Children

The 27-item youth-completed Positive and Negative Affect Schedule for Children (PANAS-C), which includes the Negative Affect subscale (15 items) and the Positive Affect subscale (12 items), was used as a measure of general

youth emotional distress [25]. The measure has evidence of high internal consistency and convergent validity [25]. Cronbach's α coefficients were 0.86 for the Negative Affect scale and 0.91 for the Positive Affect scale in the current study.

Serum hemoglobin HbA1c

A blood sample was collected for study purposes at the baseline visit to determine the youth participants' average blood sugar over the past 3 months. Results are reported in NGSP units (%) and International Federation of Clinical Chemistry and Laboratory Medicine units (mmol/mol). Samples were analyzed at a single, central laboratory by high-performance liquid chromatography with a Bio-Rad Variant™ 2 Turbo (Bio-Rad, CA, USA).

Data analysis

Comparisons between youth and parent report of treatment responsibility and diabetes-specific family conflict were made via paired-sample *t*-tests. Correlations were examined between study variables. Youth adherence and HbA1c were included as covariates in linear regression models predicting QoL due to their significant associations with QoL in the current and previous studies [6–8]. Youth general emotional distress (i.e., negative affect) was also included as a covariate. Hierarchical linear regressions were utilized following Aiken and West's guidelines [26] to test the interaction between treatment responsibility and family conflict in predicting youth QoL; independent variables were standardized into *z*-scores and multiplied to create the interaction term used to test the moderation model. Regression diagnostics were examined, and all assumptions were met. *Post hoc* examination and plotting of significant interactions were conducted [27].

Results

Sample characteristics

Sample demographics are reported in Table 1. Youth participants ranged in age from 10 to 18 years (mean [*M*] = 14.2 years; standard deviation of the mean [*SD*] = 2.4), and 61% were female. The mean HbA1c of the sample was 10.2% (*SD* = 1.8; 87 mmol/mol) with a mean duration of T1DM of 6.3 years (*SD* = 3.4). Parent/caregiver participants were mostly mothers (76%). Fathers (17%) and other legal guardians (7%) comprised the remainder of the sample. Approximately 68% of the sample was White, non-Hispanic and 20% of the sample was Black.

Relationships among study variables

Correlations among study variables are reported in Table 2. Significant group differences were observed between youth (*M* = 7.08; *SD* = 2.87) and parent (*M* = 8.25; *SD* = 2.80; *t*(71) = -3.14; *p* = 0.003) report of shared treatment responsibility, with parents reporting greater shared responsibility. Youth (*M* = 29.89; *SD* = 9.58) and their parents (*M* = 28.22; *SD* = 5.56; *t*(71) = 1.38; *p* = 0.18) reported similar levels of diabetes-specific family conflict.

Poorer youth-reported adherence and higher HbA1c were related to poorer diabetes-specific QoL (*r* = -0.34; *p* ≤ 0.01; *r* = 0.30; *p* ≤ 0.01, respectively). Youth-reported negative affect and poorer diabetes-specific QoL also correlated (*r* = 0.51; *p* ≤ 0.01). Youth report of shared treatment responsibility was associated with better diabetes-specific QoL (i.e., lower negative impact QoL scores; *r* = -0.29, *p* ≤ 0.01). In addition, youth report of greater parent treatment responsibility was correlated with poorer diabetes-specific QoL (i.e., higher negative impact subscale scores; *r* = 0.45, *p* ≤ 0.01). There were no significant correlations between parent report of family allocation of treatment responsibility and diabetes-specific QoL. Youth and parent report of diabetes-specific family conflict were not correlated with diabetes-specific QoL.

Effects of family allocation of treatment responsibility & family conflict

After controlling for youth adherence, emotional distress and HbA1c, the hypothesized interaction between youth report of shared treatment responsibility and youth report of diabetes-specific family conflict significantly predicted youth QoL (*R*² = 0.48; $\Delta R^2 = 0.07$; $\Delta F(1,61) = 8.500$; *p* = 0.005) (Table 3). The negative impact of diabetes on youth QoL was greatest when there was both low shared treatment responsibility between youth and parents and high diabetes-specific family conflict (Figure 1). Examination of the main effects revealed that less shared treatment responsibility (youth reported) was associated with poorer diabetes-specific youth QoL ($\beta = -0.32$; *p* ≤ 0.01). Similarly, greater youth-reported family conflict regarding diabetes-related issues was associated with poorer diabetes-specific youth QoL ($\beta = 0.33$; *p* ≤ 0.01). *Post hoc* probing revealed that slopes were significantly different from zero, and the relationship was significant at both high and low levels of diabetes-specific family conflict. Main and interaction effects were not

statistically significant for parent report of shared treatment responsibility and family conflict.

Discussion & conclusion

Researchers have identified family allocation of treatment responsibility and family conflict as targets for intervention given their modifiability [11]. Combined with Helgeson and colleagues’ findings that shared treatment responsibility is related to fewer child depressive symptoms, less child anger, greater diabetes self-efficacy and better adherence [9], results of the current study underscore the importance of youth and parents sharing in diabetes care. Youth who reported a combination of low levels of shared treatment responsibility and high levels of diabetes-specific family conflict reported the poorest diabetes-specific QoL. Findings are consistent with the guiding theoretical framework, the Self and Family Management Model [17], which emphasizes the importance of interactions between individual and family factors and self-management behaviors. This interaction effect may help to explain why some have found a relationship between parental involvement and youth QoL, while others have not [12–14]. When children and parents are engaging in frequent conflict related to the management of the diabetes treatment regimen and parents are not helping their child as much with their diabetes care, youth report a poorer QoL. Of note, we did not find an association between diabetes-specific family conflict and youth QoL. This is probably due to unaccounted for factors that may impact QoL in a sample of youth with poor metabolic control. As demonstrated by the current results, family sharing of treatment responsibility is one such factor that interacts with family conflict. This finding is clinically significant as results show that shared treatment responsibility may buffer the negative effects of family conflict on youth QoL (Figure 1). This finding suggests that although youth may experience T1DM-related conflict with their parents, they may find it beneficial for their parents to share in managing the demands of treatment to help them maintain a better diabetes-specific QoL. Future research should examine other variables that may interact with diabetes-specific conflict to predict health and psychosocial outcomes in youth with T1DM.

Additional research is also needed to better understand how more general family functioning may impact the interaction between family sharing of treatment responsibility and T1DM-related

Table 1. Sample demographics.

Characteristic	Patients (n = 72)
Mean youth age; years (SD)	14.2 (2.4)
Mean HbA1c (SD)	10.2%/87 mmol/mol (1.8)
Mean years since diagnosis; years (SD)	6.3 (3.4)
Youth sex	
Female; n (%)	44 (61.1)
Male; n (%)	28 (38.9)
Parent/caregiver respondent; n (%)	
Mother	55 (76.4)
Father	12 (16.7)
Other	5 (6.9)
Family race/ethnicity; n (%)	
White, non-Hispanic	49 (68.1)
Black	14 (19.4)
Hispanic/Latino	1 (1.4)
Bi-/multi-racial	8 (11.1)
Family income[†]; n (%)	
<US\$24,999	24 (34.3)
US\$25,000–74,999	30 (42.9)
US\$75,000–149,999	11 (15.7)
>US\$150,000	5 (7.1)
Parent education; n (%)	
Some high school	3 (4.2)
High school	14 (19.4)
Some college	31 (43.1)
College degree	21 (29.2)
Some graduate school	1 (1.4)
Graduate school degree	2 (2.8)
Family structure/those living in household; n (%)	
Married parents	36 (50.0)
Single mother	19 (26.4)
Single father	4 (5.6)
Mixed family	10 (13.9)
Grandparents	2 (2.8)
Other	1 (1.4)

[†]Two families did not respond (n = 70).
SD: Standard deviation of the mean.

conflict. For example, low sharing of treatment responsibility may reflect disengagement of parents from the diabetes management due to family conflict. Therefore, not only does the child have to assume responsibility for the treatment regimen independently, but also manage T1DM in a conflictual family environment. By contrast, sharing of treatment responsibility may reflect positive family factors, such as a warm family environment or an authoritarian parenting style. Despite the parents’ good intentions, youth may be bothered by over involvement of their parents, which can lead to conflict and poorer QoL.

Table 2. Correlations, means and standard deviations of key study variables.

Variable	HbA1c	SCI-R	PANAS-C (NA)	PANAS-C (PA)	DFRQ – EQ (Y)	DFRQ – EQ (P)	DFCS-R (Y)	DFCS-R (P)	DQoLY (Imp)	Mean	SD
HbA1c	–	–	–	–	–	–	–	–	–	10.2%	1.8
SCI-R	-0.29	–	–	–	–	–	–	–	–	48.3	9.5
PANAS-C (NA)	0.28*	-0.30*	–	–	–	–	–	–	–	29.5	8.8
PANAS-C (PA)	-0.20	0.33**	-0.15	–	–	–	–	–	–	42.2	9.9
DFRQ – EQ (Y)	-0.22	0.24*	-0.02	0.29*	–	–	–	–	–	7.1	2.9
DFRQ – EQ (P)	-0.16	-0.22	-0.22	0.00	0.38**	–	–	–	–	8.3	2.8
DFCS-R (Y)	-0.04	-0.13	-0.03	-0.05	0.09	0.05	–	–	–	29.9	9.6
DFCS-R (P)	0.22	-0.09	0.17	-0.06	0.24*	-0.02	0.16	–	–	28.2	5.6
DQoLY (Imp)	0.30**	-0.34**	0.51**	-0.24	-0.29*	-0.16	0.21	0.20	–	53.1	12.2

*p ≤ 0.05.

**p ≤ 0.01.

DFCS-R (P): Diabetes Family Conflict Scale – Revised (Parent Report); DFCS-R (Y): Diabetes Family Conflict Scale – Revised (Youth Report); DFRQ – EQ (P): Diabetes Family Responsibility Questionnaire – Equal Responsibility (Parent Report); DFRQ – EQ (Y): Diabetes Family Responsibility Questionnaire – Equal Responsibility (Youth Report); DQoLY (Imp): Diabetes Quality of Life Questionnaire – Youth (Impact Subscale); PANAS-C (NA): Positive and Negative Affect Schedule for Children (Negative Affect Subscale); PANAS-C (PA): Positive and Negative Affect Schedule for Children (Positive Affect Subscale); SCI-R: Self Care Inventory – Revised; SD: Standard deviation of the mean.

Interaction effects were not significant for parent report on measures. Helgeson and colleagues found that child report of shared responsibility was associated with better psychosocial youth outcomes, whereas parent report of shared responsibility was not [9]. Current findings are consistent with this work. Parents reported significantly higher levels of shared treatment responsibility than youth. It may be that parents of youth with

poor metabolic control overestimate their involvement in T1DM care; thus, youth report may more accurately reflect the division of treatment responsibility. Alternatively, parents may view their ‘monitoring’ of the child’s diabetes care as sharing in treatment responsibility (e.g., watching the child give an insulin shot), whereas child respondents do not. This could also account for some of the variation in findings between reporters.

Table 3. Hierarchical linear regressions predicting youth diabetes-specific quality of life.

Predictor	R ²	F	ΔR ²	ΔF	B (SE)	b	t	95% CI for B
Interaction between equal TR (Y) and family conflict (Y)								
Step 1	0.32	10.35**	0.33	10.35**				
HbA1c					0.95 (0.71)	0.14	1.35	-0.46, 2.37
Adherence					0.01 (0.13)	0.00	0.04	-0.26, 0.27
Negative affect					0.63 (0.14)**	0.46	4.64	0.36, 0.90
Step 2	0.41	8.67**	0.09	4.46*				
Equal TR					-3.95 (1.27)**	-0.32	-3.11	-6.49, -1.41
Family conflict					3.92 (1.21)**	0.33	3.25	1.51, 6.34
Step 3	0.48	9.51**	0.07	8.50				
Equal TR and family conflict					-3.67 (1.26)*	-0.30	-2.92	-6.19, -1.15
Interaction between equal TR (P) and family conflict (P)								
Step 1	0.33	10.35**	0.33	10.35**				
HbA1c					1.14 (0.81)	0.17	1.42	-0.47, 2.76
Adherence					-0.17 (0.14)	-0.14	-1.24	-0.45, 0.11
Negative affect					0.56 (0.15)**	0.41	3.60	0.25, 0.87
Step 2	0.33	6.17**	0.01	0.25				
Equal TR					-0.21 (1.46)	-0.02	-0.15	-3.13, 2.71
Family conflict					0.83 (1.37)	0.07	0.61	-1.90, 3.56
Step 3	0.35	5.44**	0.02	1.52				
Equal TR and family conflict					-1.76 (1.43)	-0.14	-1.23	-4.61, 1.09

All regression coefficients are from the final step.

*p ≤ 0.05.

**p ≤ 0.01.

(P): Parent report; (Y): Youth report; SE: Standard error; TR: Treatment responsibility.

Related to this, low sharing of treatment responsibility could also indicate that parents are assuming a great deal of responsibility for T1DM management. Study findings indicated that youth report of greater parent responsibility for managing diabetes-related tasks was associated with greater negative impact of diabetes on their QoL. This finding is consistent with literature that has reported associations between greater parent responsibility for T1DM care and negative child psychosocial outcomes, such as poorer youth social competence and less diabetes-specific self-efficacy [9]. Therefore, while parental involvement in care is important, findings highlight the significance of youth and parents sharing responsibility for treatment-related tasks, especially for youth with poor metabolic control, rather than the parent or child taking all of the responsibility for T1DM care.

Together, these findings inform clinical practice and future interventions. T1DM impacts the entire family system; thus, a family systems-based intervention that encourages families to work together and share in diabetes management, even in families experiencing a great deal of T1DM-related conflict, may promote better youth QoL. Notably, group-based, outpatient randomized interventions have been developed and implemented to target family teamwork in managing T1DM care [11,28]. As Murphy *et al.* discussed, their group-based intervention integrated with routine diabetes clinic care posed a number of challenges, including poor attendance to intervention sessions and difficulties individualizing intervention content [28]. These challenges probably contributed to the lack of group differences among intervention and control groups on measures assessing youth QoL and the allocation of family responsibility for T1DM management. These findings, in combination with the current study's results, highlight the importance of individualized intervention that is tailored to the needs of the family. Findings also suggest that emphasis should be placed on increasing shared treatment responsibility, rather than increasing parental involvement in T1DM management, which has largely been the focus of previous intervention studies.

Clinicians could use brief measures, such as the DFRQ [18], to assess family allocation of treatment responsibility to gain a better understanding of how youth and parents perceive T1DM care to be managed, and help families problem-solve ways in which treatment responsibilities can

be better shared. As highlighted by the Self and Family Management Model [17], both individual and family factors should be considered. For example, when assisting a family in problem-solving strategies to better share in treatment responsibility, child factors, such as age, developmental level and self-efficacy, are important to consider. Similarly, family factors, such as family structure and family communication are important. When multiple members are involved in diabetes (e.g., grandparents, siblings), shared treatment responsibility plans should be developed with an awareness of family roles and environment.

Interventions of this nature can be integrated with routine clinical care. Brief measures assessing these family constructs can be completed while the youth and family members are waiting to see medical providers. Discussion about family sharing of treatment responsibility can be easily integrated into medical visits. However, more regular follow-up care, booster sessions, and/or individual and family-based sessions with mental health professionals may promote greater and longer-lasting positive changes. Thus, based on recommendations from Murphy *et al.* [28] and current family systems-based theoretically guided research, the greatest benefits may come from brief assessment of family allocation of treatment responsibility during routine clinic visits, followed by referral to more intensive individualized intervention sessions for families in need of assistance with problem-solving better ways to share in T1DM management.

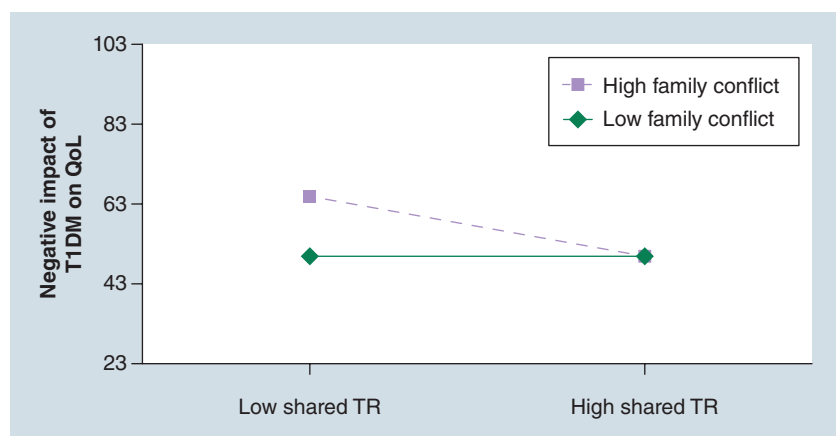


Figure 1. Shared treatment responsibility and family conflict for predicting negative impact of Type 1 diabetes mellitus on quality of life. Regression lines for relationships between youth-reported shared TR and negative impact of T1DM on QoL as moderated by youth report of diabetes-specific family conflict (two-way interaction).

T1DM: Type 1 diabetes mellitus; TR: Treatment responsibility; QoL: Quality of life.

The current study has a number of strengths, including its emphasis on illness-specific factors and outcomes, and examination of family sharing of treatment responsibility. Additionally, multiple informant reports were obtained. Results also need to be interpreted in light of some limitations. Due to the intensive nature of the larger intervention study, the sample size was limited. The sample size prevented the testing of three-way interactions including age. Given the well-documented association between age and greater youth responsibility for T1DM management [18,29,30], future research should expand upon the current study's findings utilizing a larger sample of youth of various ages to improve understanding of how age, parental involvement in care and family conflict interact. Research of this nature may increase our ability to pinpoint the age and developmental level at which interventions around family sharing of treatment responsibility would be most beneficial. Although poorly controlled T1DM is very common in youth [31], restricting the range of participants to youth with HbA1c $\geq 8.5\%$ limits the generalizability of findings. The illness-specific focus of the study may better inform interventions for youth with T1DM [32], although there are benefits to including both illness-specific and generic measures to assess common domains between youth with T1DM and healthy controls. Future research may seek to investigate the interactive effects of family variables in predicting non-illness-specific outcomes, such as depression. Furthermore, the cross-sectional nature of the study limits our understanding of causal relationships. Future longitudinal studies are needed to understand the nature of this relationship and to determine at which time points intervention is most needed.

Future perspective

It has been suggested that family allocation of treatment responsibility and family conflict are

important variables that must be considered when treating youth with T1DM [11]. The current study provides evidence of an interaction between these variables, furthering our understanding of how family allocation of treatment responsibility and family conflict relate to youth diabetes-specific QoL. The results highlight the importance of youth and parents sharing in diabetes care. Youth–parent sharing of treatment responsibility should be promoted and fostered during medical visits. Future research and clinical interventions should continue to examine correlates of shared treatment responsibility, such as HbA1c and adherence to the treatment regimen.

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Ethical conduct of research

The authors state that they have obtained appropriate institutional review board approval or have followed the principles outlined in the Declaration of Helsinki for all human or animal experimental investigations. In addition, for investigations involving human subjects, informed consent has been obtained from the participants involved.

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