Journal of Pediatric Psychology, 42(9), 2017, 922–932
doi: 10.1093/jpepsy/jsx053
Advance Access Publication Date: 25 March 2017
Original Research Article

Parenting and Treatment Adherence in Type 1 Diabetes Throughout Adolescence and Emerging Adulthood

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Received June 30, 2016; revisions received January 23, 2017; accepted February 2, 2017

Abstract

Objective To examine the role of diabetes-specific parental regulation and general parenting dimensions (responsiveness and psychological control) in treatment adherence throughout adolescence and emerging adulthood. **Methods** A total of 521 patients (aged 14–25 years) with Type 1 diabetes, 407 mothers, and 345 fathers were included. Analyses within and across informants examined the associations between the parenting variables and treatment adherence (and potential moderation effects in these associations). **Results** Lower psychological control and higher parental responsiveness were associated with better treatment adherence. Diabetes-specific parental regulation was not linked to treatment adherence, except when combined with high levels of responsiveness. Some effects of psychological control and responsiveness were more pronounced in the older age-group. **Conclusions** Researchers and clinicians should remain attentive to the potential role of parenting for treatment adherence, even in emerging adult patients.

Key words: adherence; adolescents; diabetes; parenting.

Type 1 diabetes (T1D), one of the most common chronic diseases in youth, can be stressful, as it imposes many behavioral demands (e.g., blood glucose monitoring, insulin therapy) on patients and families (Hilliard, Harris, & Weissberg-Benchell, 2012). Nonadherent behavior can lead to short- and long-term adverse health outcomes (Atkinson, Eisenbarth, & Michels, 2014). Parents play an important role in treatment adherence through their active and direct involvement in T1D management (i.e., diabetes-specific parental regulation) and through the quality of their more general parenting style (as indicated for instance by the dimensions of parental responsiveness and psychological control).

Research focusing on constructs related to diabetes-specific parental regulation (defined as setting clear rules and expectations and actively following up on them; Barber, 2002) suggests that parental monitoring of youth's diabetes management (which encompasses these active regulation components in addition to components such as parental knowledge and presence) is associated with better treatment adherence (Berg et al., 2008; Ellis, Podolski, Frey, Naar-King, Wang, & Moltz, 2007). In addition to such diabetes-specific parenting, the general quality of one's parenting style plays a crucial role as well. Two dimensions of parenting style that have been systematically related to youth's adjustment are responsiveness and psychological control (Soenens & Vansteenkiste, 2010). Responsiveness refers to the degree of support, warmth, and love in the parent–child relationship and has been found to predict general adaptive developmental outcomes (Davidov & Grusec, 2006) and better treatment adherence (Palmer et al., 2010; Young, Lord, Patel, Gruhn, & Jaser, 2014). Psychological

control refers to the degree to which parents pressure children to comply with rules or standards by using manipulative, controlling, and intrusive techniques such as guilt induction and love withdrawal. It is consistently associated with poorer treatment adherence (Lewin et al., 2006; Young et al.,2014).

Previous research on parenting and treatment adherence in T1D has focused mainly on children and adolescents, as these life phases impose many challenges potentially conflicting with treatment adherence (Shorer et al., 2011). Despite socio-cultural changes prolonging the transitional phase between adolescence and adulthood (Arnett, 2000) and research demonstrating that this period is a time of high-risk for treatment nonadherence (Bryden et al., 2001), little research has examined the role of parenting in treatment adherence in late adolescence and emerging adulthood. Emerging adulthood (ages 18–25 years) is characterized by a delay in adult role attainment (e.g., entering the jobmarket, living independently; Arnett, 2000). Such a prolonged identity quest may be accompanied by continued experimentation and a tendency to reject adult control, which limits one's receptiveness to treatment recommendations (Peters & Laffel, 2011). Although adolescents and emerging adults are geared toward independence and self-control, parental involvement tailored to the needs of these maturing patients remains an important source of support (Helgeson et al., 2014; Young et al., 2014). In the transitional phase from adolescence to emerging adulthood, while responsibility for daily diabetes management shifts gradually from parents to emerging adults, parental involvement shifts from direct involvement and monitoring to a more balanced approach of acting as backup support (Hilliard et al., 2014). Therefore, patients and parents go through a renegotiation of their roles in diabetes management (Chiang, Kirkman, Laffel, & Peters, 2014) to balance the need for ongoing parental assistance and for increasing independence (Jaser, 2011). Monaghan et al. (2015) suggest to value parents as continuing supportive "ongoing consultants" for diabetes care.

Hence, in the present study, we focused on the role of parents toward their adolescents and emerging adults with T1D. We examined the additive and interactive effects of parental responsiveness, psychological control, and diabetes-specific regulation on treatment adherence and glycemic control.

As most previous studies on parenting in T1D included mainly mothers (Jaser, 2011), the current multi-informant study included patients and both parents, hence equally valuing the role of fathers and mothers as socializing agents in this age-group.

Three objectives guided the present study. First, this study examined the associations among parenting, treatment adherence, and glycemic control throughout adolescence and emerging adulthood. In line with research suggesting that active diabetes-specific parental involvement remains important in the transition to adulthood (Helgeson et al., 2014), we generally expected a positive link between diabetes-specific parental regulation and treatment adherence. We also anticipated that dimensions of one's general parenting style would be related to treatment adherence (cf. Barber & Xia, 2013; Jaser, 2011; Nelson, Padilla-Walker, Christensen, Evans, & Carroll, 2011): responsiveness would be positively, and psychological control would be negatively, related to treatment adherence.

Second, this study examined how these parenting variables may interact in the prediction of treatment adherence and glycemic control. The study of these interactions is particularly important for diabetes-specific parental regulation because its effects may be conditional on other general parenting dimensions. Jaser (2011) stated that diabetes monitoring (which can be considered one aspect of diabetes-specific parental regulation) is effective especially when performed in a warm, collaborative manner. On the contrary, an intrusive way of rule setting has been shown to have a negative impact on patient functioning (Weissberg-Benchell et al., 2009). However, research on the interactive and combined role of these parenting variables is relatively scarce in the context of treatment adherence. Therefore, we examined whether the association between diabetes-specific parental regulation and treatment adherence is moderated by responsiveness or psychological control. We hypothesized that diabetes-specific parental regulation would be especially beneficial when performed in a climate of responsiveness, whereas it would be harmful when performed in a psychologically controlling way. Parental responsiveness may indeed increase youth's acceptance of parental rules, whereas psychological control can evoke resistance against parental involvement (Van Petegem, Soenens, Vansteenkiste, & Beyers, 2015).

Third, the present study investigated whether the association between parenting and treatment adherence was moderated by age, such that different associations would emerge for adolescents and emerging adults. For diabetes-specific parental regulation, we expected a stronger positive effect in adolescents than in emerging adults, as younger people may still need more parental assistance than emerging adults who have more self-regulatory skills and who value independence more (Arnett, 2000; Hanna, Weaver, Stump, Guthrie, & Oruche, 2014). It may indeed be that parental regulation is less effective in older individuals whose greater self-reliance may make parental rule setting and expectations less necessary or wanted (Peters & Laffel, 2011). For responsiveness and psychological control, we expected no differences

between both groups, as research confirmed the continuing importance of warm, collaborative parenting in different age-groups (Jaser, 2011) and a detrimental effect of negative and intrusive parenting (Nelson et al, 2011; Kins, Soenens, & Beyers, 2011).

Methods

Participants

Patients were selected from the Belgian Diabetes Register (BDR) using the following criteria: (1) having a diagnosis of T1D, (2) aged between 14 and 25 years, and (3) being Dutch speaking. Patients with cognitive disabilities were excluded. All participants received postal questionnaires for the patient, mother, and father separately. A total of 1,450 patients were contacted; 53 unopened questionnaire packages were returned because of an unknown or wrong address. A total of 594 questionnaires were returned (42.52%), of which 572 included patient reports (96.30%). A total of 463 mothers (33.14%) and 384 (27.49%) fathers participated. For the present study, we included 521 patients who indicated that they were still living with their parents because parents of these young adults may be more directly involved with diabetes care than those whose adult children live independently (Hanna et al., 2014). The majority of patients were female ($N = 276$; 53.2.%). Participants were 18.45 years old on average ($SD = 3.03$), and were diagnosed with T1D at the age of 9.15 years on average ($SD = 1.59$). Of the 521 included patients, physicians reported glycated hemoglobin (HbA1c) values for 400 patients (76.8%). Mean HbA1c was 7.76% ($SD = 1.44$). Data from BDR show this mean is comparable with the median of 14–25-year-old patients with T1D (median HbA1c = 7.8%; $n = 3,885$). Mean illness duration was 7.5 years ($SD = 3.03$). The majority of patients administered insulin by pen therapy (80%) rather than by pump therapy. For further participants' characteristics, see Table I. For our primary analyses, the patient–parent dyads with complete data from patient and parent on treatment adherence and glycemic control were used: 407 patient–mother and 345 patient–father dyads filled in questionnaires about treatment adherence, and for 316 patient–mother and 277 patient–father dyads glycemic control was obtained from the medical file.

Procedure

The study was approved by our institutional review board. All participants signed an informed consent form and, for minors, parental informed consent was asked; questionnaires from four minors were excluded because parental informed consent was lacking. All patients received a movie ticket for participating.

Measures

Treatment Adherence

The *Self-Care Inventory* patient and parent report (SCI; Weinger, Butler, Welch, & La Greca, 2005) is a 14-item measure to assess patient treatment adherence during the past 1–2 weeks. Item 12 ("Wearing a medic alert ID") was deleted, as this is not always part of the treatment in Europe. The SCI was translated in Dutch using the back-translation procedure. A 5-point Likert-type scale ranging from *never do it* to *always do this as recommended without fail* was used, with an additional response option stating "non-applicable." Mean adherence scores were calculated. Higher scores indicate better treatment adherence. Cronbach's alphas were .76 (patient report) and .78 (both mother and father report).

Glycated Hemoglobin

HbA1c is a proxy measure of a patient's average blood glucose levels over the past 3 months (American Diabetes Association, 2015). HbA1c values closest to the date the patients filled out the questionnaires (3 months before or after questionnaire completion) were collected from patients' medical records by

Table I. *Participants' Characteristics*

	Adolescents (n =521) (%)	Mothers (n =407) (%)	Fathers (n =345) (%)
Ethnicity			
Belgian nationality	97.7	96.8	96.3
Other European nationality	2.0	2.1	3.2
Other continent	0.3	1.1	0.5
Born in other country than Belgium		5.6	6.9
Work situation			
Student	80.3	0.0	0.0
Working	14.8	83.3	92.9
Unemployed	4.9	16.3	7.1
Education			
University or college	17.8	53.1	51.7
Secondary education	73.1	41.5	42.8
Primary education	6.7	3.2	3.2
Unqualified	2.4	2.2	2.3

contacting treating physicians. HbA1c values <7.5% or 58 mmol/mol are recommended; higher HbA1c values indicate poorer glycemic control (American Diabetes Association, 2015).

Parenting

Three parenting variables were assessed. To assess responsiveness, seven items from the Child Report of Parent Behavior Inventory (Schaefer, 1965; Schludermann & Schludermann, 1988) were used (α patient report about mother = .89; α patient report about father = .92; α mother report = .80; α father report = .84; e.g., "My parent makes me feel better after discussing my worries with him/her"). To assess psychological control, eight items of Psychological Control Scale–Youth Self Report (Barber, 1996) were used (α patient report about mother = .78; α patient report about father = .78; α mother report = .74; α father report = .74; e.g., "My parent blames me for problems of other family members"). To assess diabetes-specific parental regulation, seven items from the Parental Regulation Scale–Youth Self Report (Barber, 2002) were adapted to diabetes-specific items (α patient report about mother = .87; α patient report about father = .91; α mother report = .85; α father report = .84; e.g., "I ask questions to my son/daughter about how he/she takes care of his/her diabetes."). A 5-point Likert scale ranging from *definitely not* to *definitely* was used. Although the measures were originally designed to assess parenting in children and adolescents, all questionnaires have been used in previous studies in the same age-group as in the present study as well (Soenens, Vansteenkiste, Luyckx, & Goossens, 2006).

Results

Correlation Analyses

Table II displays correlations from the mother–patient dyad as well as the father–patient dyad. A positive correlation across informants was found between responsiveness and treatment adherence. Psychological control correlated negatively with treatment adherence, albeit less consistently across informants. Diabetes-specific parental regulation correlated positively with treatment adherence but mainly in patient reports. Better treatment adherence was correlated with lower HbA1c control across all informants. Maternal use of psychological control as reported by the patient was correlated with higher HbA1c.

Regression Analyses

To examine the unique contribution of each of the parenting variables and their interactions in the prediction of treatment adherence, four sets of regression analyses were conducted with patient-reported parenting predicting patient- and parent-reported adherence, and with parent-reported parenting predicting patient- and parent-reported adherence. These analyses were conducted separately for maternal and paternal ratings. Before calculating interaction terms, all independent variables—except for gender (0 = male; 1 = female) and type of insulin administration (0 = injections; 1 = pump)—were standardized (Cohen, Cohen, West, & Aiken, 2003). In Step 1, we added age, gender, illness duration, and type of insulin administration as control variables. In Step 2, parenting variables were added. In Step 3, all two-way parenting interaction terms were added. Finally, in Step 4, all two-way and three-way interactions with age were added. In Steps 3 and 4, we interpreted individual significant interaction terms if the chunk test indicated a significant increase in R^2 (Jaccard & Turrisi, 2003). Standardized betas and R^2-values are presented in Table III for patient–mother dyads and in Table IV for patient–father dyads. Given that none of the three-way interactions with age were significant, these interactions were deleted from the models for reasons of parsimony.

Patient–Mother Dyads. Results for maternal ratings are displayed in Table III. In Step 1, age negatively predicted patient-reported adherence, and illness duration negatively predicted mother-reported adherence. In Step 2, consistent with our first hypothesis, psychological control was a consistent negative predictor of adherence across all analyses, whereas responsiveness was a consistent positive predictor of adherence (except in the analyses including mother-reported responsiveness and patient-reported adherence). Contrary to predictions, none of the main effects of diabetes-specific parental regulation were significant.

In Step 3, in line with our second hypothesis, one interaction effect emerged within patient reports: diabetes-specific parental regulation × responsiveness positively predicted adherence. Figure 1 shows a graphical depiction of this interaction effect. The simple slope of diabetes-specific parental regulation at high levels of responsiveness (1 SD above the mean; $N = 58$; 14.3%) was positive and significant ($t = 2.66$, $p < .01$), whereas the simple slope at low levels of responsiveness (1 SD below the mean; $N = 64$; 15.7%) was not significant ($t = 0.10$, $p = .92$). Hence, diabetes-specific maternal regulation was positively related to adherence only among highly responsive mothers. With regard to the third hypothesis, in Step 4, three significant interaction effects emerged, as displayed in Figure 1. First, responsiveness as reported by patients interacted with age in the prediction of mother-reported adherence. The simple slope at high age (i.e., 1 SD above the mean; $N = 71$; 17.4%; ≥21.48 years old) was significant ($t = 4.80$, $p < .001$), whereas the simple slope at low age (i.e., 1 SD below the mean; $N = 95$; 23.3%; ≤15.42 years old) was not

Table II. *Summary of Intercorrelations, Means, and Standard Deviations for Scores on the Parenting Scale,Self-Care Inventory, and HbA1c*

Variable	1	2	3	4	5	6	7	8	9
1. Diabetes-specific parental regulation patient report	–								
2. Diabetes-specific parental regulation parent report	.29***/.36***	–							
3. Responsiveness patient report	.37***/.50***	.05/.20***	–						
4. Responsiveness parent report	.20***/.29***	.35***/.48***	.43***/.46***	–					
5. Psychological control patient report	−.09/−.17**	−.00/−.10	−.40***/−.46***	−.26***/−.15**	–				
6. Psychological control parent report	.04/−.08	.10*/−.10	−.23***/−.29***	−.33***/−.36***	.39***/.30***	–			
7. Treatment adherence patient report	.22***/.24***	.08/.14*	.27***/.29***	.16**/.12*	−.28***/−.22***	−.19***/−.10	–		
8. Treatment adherence parent report	.04/.00	.03/.14*	.27***/.18**	.28***/.21***	−.26***/−.22***	−.35***/−.24***	.61***/.48***	–	
9. HbA1c	.05/.07	−.00/.04	−.11/.01	−.07/.03	.24***/.06	.10/.05	−.29***/−.26***	−.39***/−.38***	–
M	4.08/3.64	4.24/3.96	4.15/3.81	4.34/4.08	2.13/2.05	2.05/2.06	3.79/3.81	3.88/3.96	7.65/7.56
SD	0.76/0.92	0.65/0.65	0.72/0.85	0.48/0.57	0.71/0.68	0.63/0.59	0.51/0.49	0.54/0.52	1.34/1.08

Note. Two coefficients are reported because correlations were measured in two groups of dyads: the coefficient before the slash is for the mother–patient dyad; the coefficient after the slash is for the father–patient dyad.

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

Table III. *Standardized Beta Coefficients From the Hierarchical Regression Analyses for Patient–Mother Dyads*

Predictor	Treatment adherence PR	Treatment adherence MR	HbA1c
Step 1 (R^2)	*.07***/.07****	*.04**/.04***	*.02/.02*
Sex (0 = male; 1 = female)	−.05/−.05	−.05/−.05	.01/.01
Pump (0 = no; 1 = yes)	−.03/−.03	.04/.04	.07/.07
Age patient	−.23***/−.23***	−.04/−.04	−.06/−.06
Illness duration	−.06/−.06	−.19***/−.19***	.11/.11
Step 2 (change R^2)	*.11***/.05****	*.10***/.14****	*.06***/.01*
Parental regulation	.08/.02	−.08/−.02	.09/−.02
Responsiveness	.16**/.06	.23***/.18***	−.05/−.04
Psychological control	−.21***/−.18***	−.16***/−.28***	.23***/.07
Step 3 (change R^2)	*.02*/.01*	*.01/.00*	*.00/.02*
Parental regulation × responsiveness	.11*/.01	.04/.05	.01/−.08
Parental regulation × psychological control	.03/−.05	−.07/−.03	−.05/−.02
Responsiveness × psychological control	.09/.08	.04/.03	.03/−.10
Step 4 (change R^2)	*.01/.02*†	*.02*/.02**	*.01/.01*
Parental regulation × age	−.07/−.01	−.07/−.05	.04/.03
Responsiveness × age	.05/−.02	.15**/.05	−.06/−.02
Psychological control × age	−.02/−.14**	.00/−.10*	.05/.07

Note. The coefficient before the slash is for patient-reported parenting; the coefficient after the slash is for mother-reported parenting. PR = patient reports; MR = mother reports.
†$p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

Table IV. *Standardized Beta Coefficients From the Hierarchical Regression Analyses for Patient–Father Dyads*

Predictor	Treatment adherence PR	Treatment adherence FR	HbA1c
Step 1 (R^2)	*.06***/.06****	*.04*/.04**	*.07***/.07****
Sex (0 = male; 1 = female)	−.01/−.01	.01/.01	.02/.02
Pump (0 = no; 1 = yes)	−.06/−.06	−.09/−.09	.16**/.16**
Age patient	−.22***/−.22***	.00/.00	−.13*/−.13*
Illness duration	−.05/−.05	−.15*/−.15*	.15*/.15*
Step 2 (change R^2)	*.09***/.02**	*.07***/.08****	*.01/.00*
Parental regulation	.07/.07	−.14*/.07	.11/−.00
Responsiveness	.18**/.02	.17*/.11	−.02/.03
Psychological control	−.13*/−.12*	−.17**/−.19**	.09/.03
Step 3 (change R^2)	*.01/.01*	*.01/.01*	*.02/.00*
Parental regulation × responsiveness	.13*/.04	.05/.00	−.02/.02
Parental regulation × psychological control	.02/−.00	.03/.03	.05/−.04
Responsiveness × psychological control	−.01/−.06	−.11/−.08	.10/−.00
Step 4 (change R^2)	*.01/.02*†	*.01/.00*	*.00/.00*
Parental regulation × age	−.06/.00	−.04/−.02	.04/.06
Responsiveness × age	.11/.01	.07/−.03	−.04/−.00
Psychological control × age	.03/−.14*	.11/−.05	−.03/.03

Note. The coefficient before the slash is for patient-reported parenting; the coefficient after the slash is for father-reported parenting. PR = patient reports; FR = father reports.
†$p < .10$; * $p < .05$; ** $p < .01$; *** $p < .001$.

($t = 1.06$, $p = .29$). Hence, responsiveness was positively related to adherence, especially for older participants. Second, mother-reported psychological control interacted with age in the prediction of both patient-reported and mother-reported adherence. For patient-reported adherence, the simple slope at high levels of age was significant ($t = -3.55$, $p < .001$), whereas the simple slope at low levels of age was not ($t = -0.33$, $p = .74$). For mother-reported adherence, the simple slope at high levels of age was significant ($t = -4.61$, $p < .001$), whereas the simple slope at low levels of age was marginally so ($t = -1.92$, $p = .06$). Hence, psychological control was negatively related to adherence, especially for older participants.

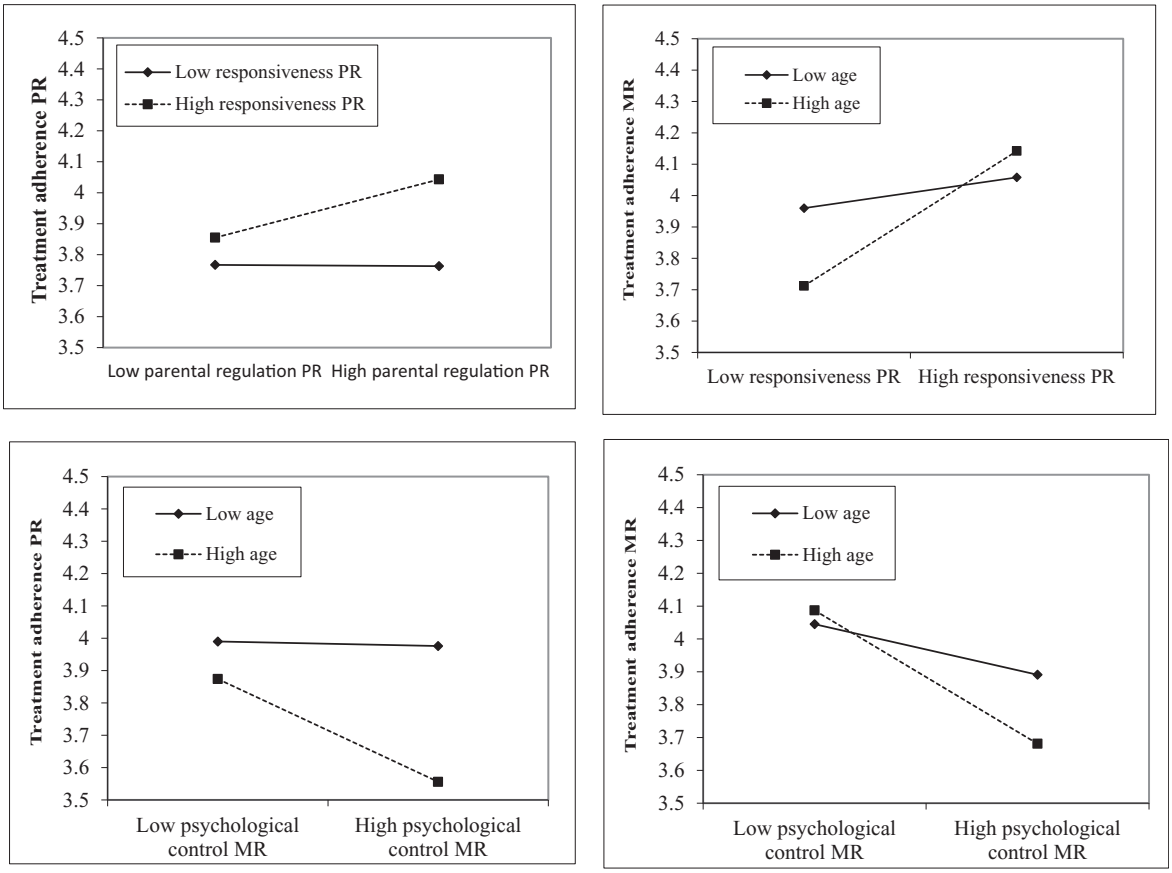

Figure 1. Significant interaction effects for adolescent–mother dyads.

Patient–Father Dyads. Results for paternal ratings are displayed in Table III. In Step 1, age again negatively and consistently predicted patient-reported adherence, whereas illness duration negatively and consistently predicted father-reported adherence. In Step 2, consistent with our first hypothesis, psychological control was a negative predictor of adherence across all analyses (although only at $p < .05$ for patient-reported adherence). Patient-reported (but not father-reported) responsiveness positively predicted adherence. Diabetes-specific parental regulation was unrelated to treatment adherence, with the exception of a negative association between patient-reported diabetes-specific paternal regulation and father-reported adherence. In Step 3, the same significant interaction effect as for patient–mother dyads emerged for adolescent reports: the diabetes-specific parental regulation $\times$ responsiveness interaction term again significantly predicted adherence. However, given that the corresponding chunk test did not reach significance, this interaction term is not plotted. In Step 4, similar to the analyses for patient–mother dyads, father-reported psychological control interacted with age in the prediction of patient-reported adherence. This interaction term is displayed in Figure 2. The simple slope at high levels of age was significant ($t = -2.92$, $p < .01$),

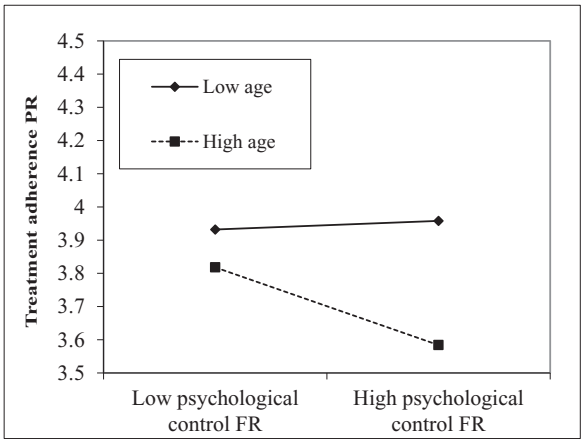

Figure 2. Significant interaction effects for adolescent–father dyads.

whereas the simple slope at low levels of age was not ($t = 0.20$, $p = .84$). Hence, psychological control was negatively related to adherence, especially among older patients.

Finally, we explored the degree to which parenting predicted HbA1c values (as displayed in Tables 2 and 3). In Step 1 (but only in the patient–father dyads), using an insulin pump, being younger, and having a longer

illness duration were related to higher HbA1c values. In Step 2, only patient-reported maternal psychological control positively predicted HbA1c values. None of the interaction terms in Steps 3 and 4 reached significance in patient–mother and patient–father dyads.

Discussion

The present multi-informant study extends prior work examining associations between parenting and treatment adherence to T1D by focusing on different features of parenting (and how they interact) in adolescents and emerging adults. Consistent with the first hypothesis, psychological control was consistently associated with poorer treatment adherence across informants. Results also suggested that responsiveness was associated with better treatment adherence, although less consistently as compared with psychological control. These results are consistent with previous research indicating an overall detrimental effect of a critical and intrusive way of parenting on treatment adherence and a positive effect of a warm and caring parenting climate (Lewin et al., 2006). However, contrary to our hypothesis, diabetes-specific parental regulation had no unique effect when effects of psychological control and responsiveness were taken into account. Hence, the present findings seem to indicate that, when looking at unique parenting effects, the setting of diabetes-specific rules and regulation in itself has no relationship with treatment adherence in adolescents and emerging adults. Such a lack of a unique effect again emphasizes the importance of examining other defining parenting features as well (and, as detailed below, their complex interplay) to capture possible contextual mechanisms feeding into treatment adherence.

With respect to glycemic control, we found only a negative association with mother-reported psychological control. Contrary to other findings (Shorer et al., 2011), associations of diabetes-specific parental regulation and responsiveness with glycemic control were not significant. These findings are similar to the study by Monaghan, Horn, Alvarez, Cogen, & Streisand (2012). The link between parenting and HbA1c may be more indirect in nature through self-management (Lewin et al., 2006). Indeed, as expected, we found negative associations between HbA1c and treatment adherence across informants.

Results partially confirmed our second hypothesis and earlier research (Gray & Steinberg, 1999; Jaser, 2011; Soenens & Vansteenkiste, 2010) that diabetes-specific parental regulation is especially beneficial to treatment adherence when performed in a responsive climate. This interaction effect was found in patient-reports about parenting by mothers and fathers (although in the latter case, the chunk test was not significant). This same interaction–effect was not found when mothers and fathers reported about their parenting, underscoring the importance of the perception of the patient of how parental rules are experienced. Contrary to our hypothesis, the interaction effect between diabetes-specific parental regulation and psychological control was not significant in any of the analyses. Provided that future research replicates these results, these findings seem to point to a stronger moderation effect of positive parenting behaviors such as responsiveness in setting diabetes rules than of negative parenting behaviors such as psychological control. However, as noted, the negative effect of psychological control in itself on treatment adherence was consistent across all informants, again pointing to the importance for parents to refrain from using such intrusive techniques.

Finally, the results partially supported our third hypothesis, suggesting that there may be more similarities than differences between age-groups. Contrary to our hypothesis, for diabetes-specific parental regulation, we did not find an interaction effect with age. To examine in-depth whether diabetes-specific parental regulation remains important throughout emerging adulthood (and under which conditions), further longitudinal research is needed. With respect to responsiveness, results supported our hypothesis that there would be no difference between adolescents and emerging adults, suggesting the positive effect of this parenting dimension regardless of age (except for one interaction–effect), demonstrating that lack of responsiveness (as reported by patient) was especially detrimental in emerging adulthood toward mother-reported treatment adherence). For the interaction of psychological control and age, more consistent findings were obtained for both maternal and paternal parenting. Parent- but not patient-reported psychological control was detrimental toward treatment adherence especially in emerging adulthood. This points to age-related detrimental effects of psychological control as reported by parents and to an overall negative impact of patient perceptions of psychological control, regardless of age. Overall, findings suggest that psychological control by parents remains detrimental to the patient's functioning well into emerging adulthood.

Clinical Implications

Provided that the present findings are replicated longitudinally, translation into future intervention efforts may be valuable. First, family-based interventions help families to interact constructively about T1D (Anderson, 2004). As parental involvement in this specific age-group is going through critical changes,

clinical interventions should aim for balanced and developmentally appropriate parental involvement, tailored to the needs of each individual and family. Interventions such as multifamily group interventions (Depestele, Claes, & Lemmens, 2015), actively involving families and parents of adolescents and emerging adults may be of great use. Adding a component of psycho-education for parents concerning age-appropriate responsive and nonintrusive parenting practices and communication may be beneficial in this specific age-group. As the older age-group of emerging adults consult the diabetes team more independently without parents being present (Hilliard et al., 2014), clinicians might benefit from engaging in a dialogue with their patient and/or the parents about the optimal support parents can provide. The multidisciplinary team can be a model for parents through their supportive communication, offering encouragement, and positive feedback rather than criticizing the T1D management. Second, as this study supports earlier findings that parental involvement in disease management remains important throughout adolescence and emerging adulthood (Young et al., 2014), transition programs may need some restructuring (Ritzhold et al., 2014). Parallel to the focus on the enhancement of youth's autonomy in diabetes care, it would be valuable for clinicians to acknowledge and stimulate balanced parental involvement and support, for instance by valuing parents as continuing supportive "consultants" for the diabetes care (Markowitz, Parsons, & Advani, 2016; Monaghan et al., 2015). Third, as most effects were similar for mothers and fathers, this study confirms the vital role of fathers in treatment adherence (Young et al., 2014). This implies the meaningfulness of actively involving fathers in the diabetes care of their children independent of their age.

Limitations and Suggestions for Future Research

The present study is characterized by some limitations. First, owing to the cross-sectional design, directional interpretations of the results should be made with caution. Future research should test longitudinal associations to allow for a more in-depth understanding of the link between parenting and treatment adherence, which can be hypothesized to be bidirectional. Second, two of the three parenting dimensions (responsiveness and psychological control) were measured with general and not diabetes-specific questionnaires. As parents may interact with children differently in the context of diabetes-specific behavior (compared with their general style of interaction), it may be beneficial for future research to use diabetes-specific measures for all parenting dimensions. For diabetes-specific parental regulation specifically, the lack of direct associations with patient functioning might be partially owing to the use of an adapted measure. Hence, future research should look into the validity of this measure. Third, the parenting measures used were originally designed to assess parenting in children and adolescents, and may have different implications for an emerging adult sample. Future research may benefit from the development of age-appropriate questionnaires tailored to the needs of the specific older age-group of emerging adults. Fourth, a few elements in the study may question the representativeness of the sample. Although the response rate is equivalent to other studies in T1D using national patient registries (Luyckx et al., 2008), it is only moderate. Furthermore, although HbA1c values were obtained for the majority of participating patients (76.9%) and were similar to the population mean, these values could not be obtained for participants without a medical visit during the study window. Moreover, there was a possible time frame of 3 months in between filling out the questionnaires and the measurement of HbA1c. Ideally, this measurement is done at the same time as the completion of the questionnaires. Finally, future clinical interventions in the older age-group of adolescents and emerging adults more specifically, may benefit from research on how to involve parents in an age-appropriate and balanced way (e.g., how to involve parents when emerging adults consult individually).

Conclusion

This study adds to the diabetes literature by demonstrating associations between three features of parenting (diabetes-specific parental regulation, responsiveness, psychological control) and treatment adherence, emphasizing the continuing importance of warm, responsive, and noncritical or nonintrusive parental involvement in the challenging transition to adulthood. In addition, future clinical interventions integrating these findings should not only focus on mothers but also target fathers as equal partners in the parenting process of adolescents and emerging adults with T1D.

Funding

Funding was provided through research project G.0B35.14N granted by FWO Flanders to the last author and through the Clinical Research Fund of the University Hospital Leuven granted to the first author. *Conflicts of interest*: None declared.

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