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Mindfulness, Worries, and Parenting in Parents of Children With Type 1 Diabetes

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Abstract

Objective Parents of children with type 1 diabetes (T1D) often experience distress and worries, which may negatively impact their parenting behaviors. The current study investigates parental mindfulness (i.e., an enhanced attention to and awareness of current experiences or present reality) as a resilience mechanism. Using a daily diary approach, the predictive role of parental mindfulness for daily diabetes-related worries was examined, its impact upon protective parenting behaviors, and its buffering role in the relationship between daily worries and protective parenting behaviors. **Methods** Participants were 56 parents of 40 children with T1D (2–12 years). Trait mindfulness was assessed with the Mindful Attention Awareness Scale. Subsequently, parents completed a diary for 14 consecutive days, assessing parental worries about hypo- and hyperglycemia and general and diabetes-specific parental protective behavior. **Results** Multilevel analyses showed that parental diabetes-related worries fluctuated substantially across days and positively predicted daily protective behavior. Higher levels of parental mindfulness predicted less daily worries about hypoglycemia and lower engagement in general protective behavior and hypoglycemia avoidance behavior. In addition, the relationship between worries about hyperglycemia and general protective behavior was moderated by parental mindfulness. **Conclusions** The present findings highlight the importance of daily parental worries in explaining parental protective behaviors on a daily basis. Mindfulness emerged as a promising resilience factor in parents of children with T1D, resulting in less daily worries and protective parenting. These results have important clinical implications and point to the promising role of mindfulness interventions in this context.

Key words: diabetes; parenting; parent stress.

Introduction

In young children with type 1 diabetes (T1D), the responsibility for diabetes management lies especially with the primary caregivers, in most cases the parents. Both the diagnosis and the complex treatment regimen (e.g., blood glucose monitoring and insulin therapy) may elicit psychological distress in parents, which can be reflected in frequent worries, symptoms of depression, posttraumatic stress, and anxiety (Whittemore, Jaser, Chao Jang, & Grey, 2012). Especially parents of young children report high levels of distress (Stallwood, 2005). The most prominent ongoing worries encompass the responsibility of maintaining adequate blood glucose levels to avoid short- and long-term health complications (e.g., hypoglycemia or kidney disease; Whittemore et al., 2012).

Parental diabetes-related distress might reflect continued parental involvement in diabetes care and has been associated with improved physical health behaviors (e.g., blood glucose checking; Helgeson, Becker, Escobar, & Siminerio, 2012). However, available evidence shows that increased levels of distress and excessive worry can have negative implications for the child's psychological well-being (e.g., reduced quality of life and depressive symptoms), parents' mental health, and family functioning (e.g., more conflict; Whittemore et al., 2012). Other studies revealed associations with child anxiety (Van Gampelaere et al., 2018), parent-reported behavior problems (Hilliard, Monaghan, Cogen, & Streisand, 2011), mealtime behavior problems (Powers et al., 2002), school absenteeism, poor treatment adherence (Cameron, Young, & Wiebe, 2007; Freckleton, Sharpe, & Mullan, 2014), poor glycemic control (Viaene, Van Daele, Bleys, Faust, & Massa, 2017), and less adaptive parenting (Robinson, Weaver, Chen, Streisand, & Holmes, 2016).

Given the omnipresence of distress and worry in parents of children with T1D, a prominent research question is to identify individual parent characteristics that may mitigate distress and act as a resilience mechanism. *Trait mindfulness*, defined as "a receptive attention to and awareness of present events and experiences" might be a potential candidate (Brown, Ryan, & Creswell, 2007, p. 212). Indeed, worries and distress have been shown to narrow an individual's perspective and the scope of their attention (Garland et al., 2010). For instance, distressed parents may be focused more intensely toward threatening cues, signaling potential diabetes complications (e.g., hypoglycemia). Mindfulness is expected to counteract that narrowing effect, broadening parents' attention, and has been suggested to facilitate adaptive coping strategies and foster emotion regulation (Brown et al., 2007; Garland et al., 2010; Weinstein, Brown, & Ryan, 2009). This assumption has been supported by several empirical studies. These studies have shown that adults with diabetes who are more mindful experience less depression and anxiety and a higher quality of life (Caluyong et al., 2015; van Son et al., 2015). Furthermore, research showed that mindfulness buffers against the negative influence of stressful life events on emotional well-being in these patients (van Son et al., 2015). In parents, trait mindfulness has been associated with a better ability to cope with stressors such as child behavior problems (Chan & Lam, 2017). In parents of children with T1D, it has been related to lower fear of hypoglycemia (Aalders et al., 2018). These findings suggest that parental mindfulness may play a promising role in alleviating the burden of daily worry.

Next to mitigating parental distress, parental mindfulness may also influence the behaviors parents engage in. Previous research has shown that parents of children with chronic health problems seem to be more *protective* than other parents (Holmbeck et al., 2002). Although these behaviors may have favorable health-related effects (e.g., reducing risk of hypo- and hyperglycemia), there may be a psychological cost for the child. In children with cancer and spina bifida, high levels of protective parenting have been related to reduced child quality of life (Hullmann, Wolfe-Christensen, Meyer, McNall-Knapp, & Mullins, 2010) and psychological adjustment problems (Holmbeck et al., 2002). In young people with chronic conditions, including T1D, While and colleagues (2017) identified significant negative associations between maternal protective behavior and youth quality of life. Furthermore, studies demonstrated that highly anxious parents engage to a higher extent in generally protective behaviors such as keeping their child home from school or social activities because of the T1D (Cameron, Young, & Wiebe, 2007) and diabetes-specific protective behaviors (i.e., hypoglycemia avoidance behavior) such as keeping blood glucose levels above recommended levels (Freckleton et al., 2014). We posit that parental trait mindfulness, which includes an awareness of one's behavior and promotes behavioral self-control and flexibility (Brown et al., 2007), may influence daily parenting in the T1D context and act as a buffer against the negative effects of distress and worries upon parental protective behaviors. Research supports this by showing that mindful parents engage in less negative parenting behaviors (Parent, Mckee, Rough, & Forehand, 2016). Furthermore, as stated earlier, mindfulness might counteract the narrowing effects of distress on one's perspective-taking and attention and buffer against the effects of distress on parenting (Garland et al., 2010).

Using a diary approach, the primary aim of the current study was to examine parental trait mindfulness

as a resilience mechanism. Mindfulness may act as a buffer against daily parental worries about hypo- and hyperglycemia (as an indicator of daily diabetes-related distress) and may mitigate the maladaptive associations of such daily worries with protective parenting behaviors. Given the paucity of research on daily fluctuations of parental worries and of protective behavior in the context of their child's T1D, a first research question addressed the extent of fluctuations in daily worries about hypo- and hyperglycemia as well as protective behavior across days. Second, the predictive role of parental trait mindfulness for daily worries and daily protective parenting behaviors was examined, hypothesizing that higher levels of mindfulness would predict lower levels of daily diabetes-related worries and lower engagement in protective parenting behaviors (i.e., less general protective behavior and less hypoglycemia avoidance behavior). Third, we hypothesized that higher levels of daily worries would be associated with more protective parenting and that parental mindfulness would moderate the associations between parental worries and protective parenting. More specifically, we expected that the hypothesized positive relations between worries and protective behavior would be weaker in parents with higher levels of mindfulness.

Method

The current study is part of the Interpersonal Risk and Resilience in Childhood Diabetes project (IRRiCD), conducted in Flanders, Belgium. The IRRiCD research project consists of a diary study, a prospective questionnaire study, and an observational study. The current article reports on the diary study and parental mindfulness as measured during the first wave (T1) of the prospective study. Specific details of the IRRiCD study can be found in the protocol (http://hdl.handle.net/1854/LU-8535160). The study was approved by the ethical committees of the university hospitals of Ghent, Leuven, Antwerp, and Brussels.

Participants

Parents of children with T1D were recruited through the pediatric diabetes services of four university hospitals in Flanders (Ghent, Leuven, Antwerp, and Brussels). To be eligible for study participation, the child had to (a) be diagnosed with T1D for at least 6 months, (b) be of age 2–12 years, and (c) have at least one parent that was Dutch-speaking. All families who met the inclusion criteria and had a routine clinical visit between July 2016 and January 2017 received information about the project from their treating physician. Families who agreed ($N = 80$) were phoned by a research assistant. Fifty families agreed to participate in the diary study. Parent-reported lack of time was the most commonly reported reason for nonparticipation. Seven families later withdrew from the diary study owing to various reasons (see http://hdl.handle.net/1854/LU-8535160 for an overview). Owing to methodological issues (i.e., fewer than seven valid diary observations), three mother–father dyads were excluded, resulting in a final sample of 40 families (16 mother–father dyads, 20 mothers only, and 4 fathers only). Demographics are presented in Table I.

Data Collection Procedure

In a first phase, all parents were sent an e-mail containing information about the study, the secured weblink to the online questionnaires, and a personal code. They completed the questionnaires at home (i.e., prospective questionnaire study). In a second phase, parents received additional information about the diary study and were asked to complete the diary every evening during 14 consecutive days. All participants received an e-mail containing the secured weblink to the online diary and a personal code and were sent daily text messages at 7 PM as a reminder to complete the diary. Diaries were completed during school weeks and started shortly after questionnaire administration. All parents provided online informed consent. When participants preferred to complete the questionnaires and diaries on paper (i.e., one parent), paper versions were sent and returned by mail. All parents who completed at least 10 out of 14 daily diaries received a movie ticket.

A total of 781 end-of-day diary observations were completed. Records completed after 10 AM the next day or before 4 PM the same day were deleted ($N = 19$; Nezlek, 2012). In addition, in case of multiple completions on the same day, the first completions were deleted ($N = 15$). Six parents were excluded from the analyses (fewer than seven valid records). As such, 695 records were included in the analyses, representing 89% of all possible records (14 days × 56 parents = 784). On average, parents completed 12 out of 14 diaries (range: 7–14).

Hemoglobin A1c

The mean of two values of the child's hemoglobin A1c (HbA1c) was used as an indicator of glycemic control: the most recent value before and the first value obtained after completion of the diary.

Questionnaire Measure

Parental dispositional mindfulness was assessed via the Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003). The MAAS encompasses 15 items, rated on a 6-point Likert scale (1 = *almost always*, 6 = *almost never*), and measures "the presence or absence of attention to and awareness of what is occurring in the present" (Brown & Ryan, 2003, p. 824).

Table I. *Demographic Characteristics of the Sample*

	N (%)	Mean	Range	*SD*
Child (*N* = 40)				
Age		8.94	4–12	2.30
Months since diagnosis		48.45	6–110	29.74
HbA1c		6.87	5.65–8.13	.63
Nationality				
Belgian	40 (100%)			
Treatment				
Daily injections	28 (70%)			
Pump	12 (30%)			
Gender				
Girls	22 (55%)			
Boys	18 (45%)			
Parent (*N* = 56)				
Age		41.12	31–62	5.47
Nationality				
Belgian	54 (96%)			
Polish	1 (2%)			
Italian	1 (2%)			
Gender				
Mother	64%			
Father	35%			
Marital status				
Married/cohabiting	54 (96%)			
Divorced	1 (2%)			
Blended family	1 (2%)			
Education				
Highly educated (>18 years)	34 (60%)			
High school	20 (36%)			
Middle school	2 (4%)			
Employment				
Continued working after diagnosis	42 (75%)			
Reduced working hours	13 (23%)			
Stopped working	1 (2%)			
Most involved in diabetes care				
Mother	15 (38%)			
Father	1 (3%)			
Both equally involved	21 (53%)			
Missing	3 (8%)			

Note. When both parents participated, demographic information of the child was aggregated across both reports or counted as missing when both reports differed and aggregation was no option (e.g., glucose checking).

Table II. *Reliability Diary Constructs*

Construct	Within-parent α	Between-parent α	Between-couple α
Worries about hypoglycemia	.69	.78	.89
General protective behavior	.62	.66	.97
Hypoglycemia avoidance behavior	.58	.77	.91

Note. Reliabilities were estimated by a multilevel confirmatory factor analysis framework (Geldhof, Preacher, & Zyphur, 2014).

Scores range from 15 to 90. The original version of the MAAS demonstrated good psychometric properties (i.e., test–retest reliability of .81; Brown & Ryan, 2003). In the current study, the Dutch version showed adequate internal consistency (α = .92).

Diary Measures

The parents were asked to rate on a 7-point Likert-scale (0 = *not at all*, 6 = *a lot*) the following factors of interest: diabetes-related worries about hypoglycemia and hyperglycemia, parental hypoglycemia avoidance behavior, and general protective behavior. All items were selected from reliable instruments based on their suitability for daily use or based on expert counseling and adapted for the daily context. A multilevel confirmatory factor analysis framework was used to estimate level-specific reliabilities. Within-parent, between-parent, and between-couple alphas are reported (see Table II; Geldhof, Preacher, & Zyphur, 2014).

Worries about hypoglycemia were assessed by means of three items: two were selected from the Hypoglycemia Fear Survey—Parents of Young Children (HFS-P-YC; Patton, Dolan, Henry, & Powers, 2008; i.e., "To what extent did you worry today about your child having a low blood sugar?" and "To what extent did you worry today that your child would act funny in a social situation due to a low blood sugar?"). The third item was constructed based on expert counseling (i.e., "To what extent did you worry today that you or somebody else would not act in time when your child had a low blood sugar?"). *Worries about hyperglycemia* were assessed by means of one item, based on expert counseling (i.e., "To what extent did you worry about your child having high blood sugar today?"). Two types of *parental protective behavior* were assessed. *Parental hypoglycemia avoidance behavior* was measured with three items, based on the HFS-P-YC (Patton et al., 2008). The items questioned parents to what extent they (a) ensured that their child's blood sugar was kept (too) high that day by, for example, giving less insulin, giving something extra to eat, or keeping him/her quiet … to prevent low blood sugar and feel safe; (b) ensured that their child's blood sugar was checked often that day (by themselves, a caregiver, or their child), even when he/she was at school or a long event (e.g., party, dance, gymnastics, or karate) to prevent low blood sugar; and (c) acted immediately that day when they thought their child could go low (e.g., give something to eat, give less insulin, or keep your child quiet). *General parental protective behavior* was assessed by means of three items. Two items were selected from the Parental Overprotection Scale (Edwards, Rapee, & Kennedy, 2010; i.e., "To what extent did you do everything to prevent or avoid situations where your child could do something dangerous today?" and "To what extent did you keep a close eye upon your child today?"). The third item was based

on expert counseling (i.e., "To what extent did you ensure you kept within a close distance of your child as much as possible today?").

Diary Validation

To validate the diary, the method of discriminant content validity (DCV) was used (Johnston et al., 2014). Fourteen experts rated the extent to which each item measures the defined constructs. Based on the DCV method, one item of the original item pool was omitted and one item formulation was adapted. Subsequently, cognitive interviews (Beatty & Willis, 2007) were conducted with nine caregivers of eight children with T1D (5–12 years). For each item, the researcher asked the participant three standardized questions to evaluate (a) how he/she came to his/her answer to the item, (b) which period he/she took into account while answering, and (c) which difficulties he/she experienced in understanding the item. Based on the interviews, five items were adapted to improve comprehensibility.

Data Analytic Strategy

Given the hierarchical structure of the data, multilevel regression analyses were run using hierarchical linear modeling (HLM version 7.01 software package; Raudenbush & Bryk, 2002). The data consisted of three levels, where daily observations (Level 1) were nested within parents (Level 2), who were nested within dyads (mother and father of a particular child; Level 3). When only one parent participated, the data point for the other parent was considered missing. Level 1 predictors were continuous and group mean centered (i.e., person mean centered), whereas continuous Level 2 and Level 3 predictors were grand mean centered. Child gender (Level 3) was dummy coded (male = 0; female = 1) and entered uncentered (Nezlek, 2012). To facilitate interpretation, Level 2 predictors were standardized. In each model, the slopes of the Level 1 and 2 variables were fixed on the third level (i.e., equal for each dyad) because the dyads had not enough lower level units to allow them to vary from dyad to dyad (Kenny, Kashy, & Cook, 2006). Full maximum likelihood estimation was used for all analyses. QQ plots of the residuals were visually inspected to check for normality.

A first set of analyses examined the predictive value of parental mindfulness for daily parental worries. A model building procedure was used for each outcome (i.e., worries about hypoglycemia and hyperglycemia). First, a baseline model was estimated to calculate the level of variance at day, parent, and dyad levels. Second, child gender, age, and diabetes duration were added to control for their influence. In a final step, mindfulness (MAAS) was added as a Level 2 predictor. A second set of analyses was performed to examine the predictive value of parental worries and the moderating role of parental mindfulness on protective parenting behavior. After estimating a baseline model for each outcome (i.e., general protective behavior and hypoglycemia avoidance behavior), third-level control variables (child age, gender, and diabetes duration) were added. Third, Level 1 predictors were added to the model. In the fourth step, parental mindfulness was added as a Level 2 predictor. Up to this step, the slopes of the Level 1 predictors were kept fixed. In a fifth step, they were allowed to vary at Level 2. Only when the random error term of a slope was significant ($p < .05$), cross-level interactions between the Level 1 and Level 2 predictors were added in the sixth step to investigate the moderating role of parental mindfulness. When nonsignificant ($p > .05$), the slopes were kept fixed.

Results

Day-to-Day Fluctuation in Daily Parental Worries and Behavior

Initial analyses indicated that diabetes-related worries varied substantially from day to day. Specifically, 43% of the variance in worries about hypoglycemia was situated within parents, 9% within dyads, and 46% between dyads. Forty-five percent of the variance of worries about hyperglycemia was situated within parents, 11% within dyads, and 46% between dyads. Furthermore, baseline models indicated that 28% of the variance in general protective behavior was situated within parents, 12% within dyads, and 60% between dyads. For hypoglycemia avoidance behavior, 43% of the variance was situated within parents, 13% within dyads, and 44% between dyads.

Does Parental Mindfulness Predict Daily Parental Worries?

The models containing only control variables as predictors showed that child age ($ps \geq .324$) and gender ($ps \geq .052$) were unrelated to worries. Parents of children with longer diabetes duration, $\gamma_{003} = .02$, $t(36) = .01$, $p = .043$, worried more about hyperglycemia. After including mindfulness as a predictor, results showed that parents who scored higher on trait mindfulness reported significantly less daily worries about hypoglycemia, $\gamma_{010} = -.26$, $t(15) = -3.33$, $p = .005$. Contrary to expectations, mindfulness was unrelated to worries about hyperglycemia, $\gamma_{010} = -.20$, $t(15) = -1.88$, $p = .08$ (see Table III).

Do Daily Worries and Mindfulness Predict Daily Parental Behavior and Does Mindfulness Have a Moderating Role?

General Protective Behavior

Child gender ($p = .622$), age ($p = .098$), and diabetes duration ($p = .162$) were unrelated to general

Table III. *Final Hierarchical Linear Models Assessing the Impact of Parental Mindfulness on Daily Worries About Hypo- and Hyperglycemia*

	Worries about hypoglycemia		Worries about hyperglycemia	
Within-parent variance (L1)	43%		45%	
Within-couple variance (L2)	9%		11%	
Between-couple variance (L3)	46%		46%	
	β	SE (β)	β	SE (β)
Intercept (γ_{000})	1.10	0.21***	1.20	0.28***
Mindfulness (γ_{010})	−0.26	0.08**	−0.20	0.11
Child age (γ_{001})	−0.05	0.06	-0.10	0.08
Child gender (γ_{002})	0.20	0.31	0.90	0.41*
Child diabetes duration (γ_{003})	0.01	0.01	0.02	0.01*

Note. $Y_{ijk} = \gamma_{000} + \gamma_{001} \times$ (child age) $+ \gamma_{002} \times$ (child gender) $+ \gamma_{003} \times$ (child diabetes duration) $+ \gamma_{010} \times$ (mindfulness) $+ r_{0jk} + u_{00k} + e_{ijk}$.
$^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

protective behavior in the model with only control variables. After including the Level 1 predictors, the model indicated that both worries about hypoglycemia, $\gamma_{100} = .08$, $t(597) = 2.01$, $p = .045$, and hyperglycemia, $\gamma_{200} = .06$, $t(597) = 2.17$, $p = .03$, were significant predictors of general protective behavior. Mindfulness was found to be a significant Level 2 predictor of protective behavior, $\gamma_{010} = -.22$, $t(15) = -2.16$, $p = .047$. As the random error terms of the slopes of the Level 1 predictors were significant, cross-level interactions were added in a last step. One significant interaction effect was found, $\gamma_{210} = .07$, $t(11) = 2.48$, $p = .031$, indicating that in parents with high levels of mindfulness, a positive association was present between worries about hyperglycemia and general protective behavior, whereas parents with low levels of mindfulness consistently showed high levels of protective behavior, independent of their level of worries (see Figure 1). The interaction between mindfulness and worries about hypoglycemia was not significant.

Hypoglycemia Avoidance Behavior

Child age ($p = .637$) and gender ($p = .629$) were not related to hypoglycemia avoidance behavior. Parents of children with a longer diabetes duration engaged in more hypoglycemia avoidance behavior, $\gamma_{003} = .01$, $t(36) = .01$, $p = .025$. Worries about hypoglycemia predicted hypoglycemia avoidance behavior, $\gamma_{100} = .48$, $t(597) = 11.81$, $p < .001$, whereas worries about hyperglycemia did not, $\gamma_{200} = .06$, $t(597) = 1.95$, $p = .052$. Mindfulness showed a significant negative association with hypoglycemia avoidance behavior, $\gamma_{010} = -.23$, $t(15) = -2.37$, $p = .032$. As analyses indicated significant slope variance, cross-level interactions were added. In contrast to expectations, both interaction terms failed to reach significance. All final models can be found in Table IV.

Results remained the same when HbA1c was added as a covariate in all models and indicated that HbA1c was unrelated to all outcome variables. Furthermore, a post hoc multilevel analysis showed that parental mindfulness and HbA1c of the child were not significantly associated, $\gamma_{010} = -.002$, $t(35) = -.008$, $p = .994$.

Discussion

T1D affects the whole family and may elicit high levels of distress in parents (Whittemore et al., 2012). To shed light on daily parental experiences and behavior, this diary study examined parental trait mindfulness, diabetes-related worries, and protective parenting behavior in the context of T1D in young children. The current study is the first to show that parental diabetes-related worries and parental protective behaviors, especially hypoglycemia avoidance behaviors, vary substantially from day to day, indicating that worries and protective parenting are not necessarily characteristic to a parent. This points to the importance of examining these concepts by means of diary studies and also indicates that worries and protective behavior may be dependent on daily experiences. It may therefore be important to search for resilience factors that can help parents to cope with these experiences.

Results furthermore indicate that child age and gender were unrelated to parental worries. This is in contrast with previous research which indicates that parents of younger children report more stress (Stallwood, 2005). Age and gender also appeared to be unrelated to parental protective behavior, although the relation between child age and general protective behavior just failed to reach significance in the model with only control variables and became significant when the other predictors were added (see Table IV). It can indeed be expected that parents are more protective toward younger children. However, as the children in the current study have T1D, this effect might be less clear. Research on protective behavior is scarce in this context, and further examination of the effects of child age is therefore warranted. Furthermore, results indicated that parents of children who had a longer diabetes duration engaged in more hypoglycemia avoidance behavior and experienced more worries about hyperglycemia. This may be explained by the fact that parents often have more negative experiences with hypo- and hyperglycemia when their child has T1D for a longer time.

Interestingly, mindfulness emerged as a buffer against daily worries and maladaptive parenting. Parents with a higher present-moment focus and

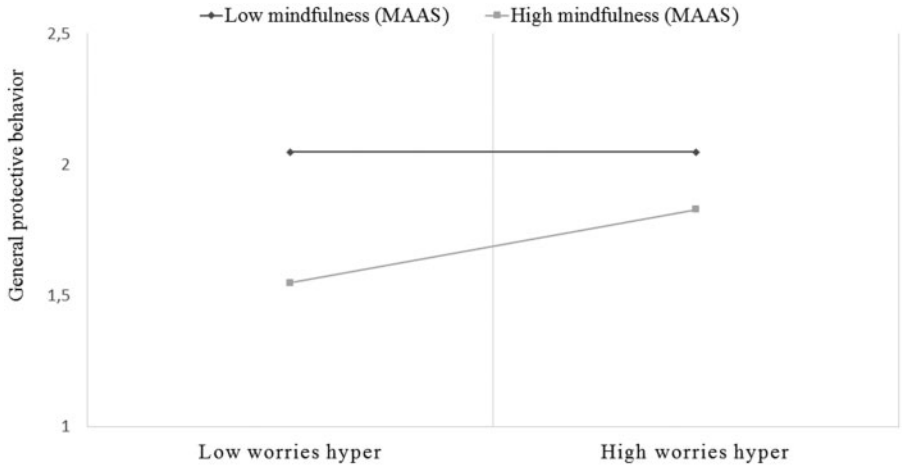

Figure 1. Interaction between worries about hyperglycemia and mindfulness on general protective behavior.

Table IV. *Final Hierarchical Linear Models Assessing the Influence of Daily Parental Worries and Parental Mindfulness on Daily Parental Behavior*

	General protective behavior		Hypoglycemia avoidance	
Within-parent variance (L1)	28%		43%	
Within-couple variance (L2)	12%		13%	
Between-couple variance (L3)	60%		44%	
	β	SE (β)	β	SE (β)
Intercept (γ_{000})	1.87	0.27***	1.28	0.23***
Worries hypo (γ_{100})	0.08	0.06	0.54	0.06***
Worries hyper (γ_{200})	0.07	0.03*	0.09	0.04
Mindfulness (γ_{010})	−0.19	0.10	−0.24	0.10*
Child age (γ_{001})	−0.16	0.08*	−0.03	0.07
Child gender (γ_{002})	−0.16	0.39	0.27	0.34
Child diabetes duration (γ_{003})	0.01	0.01	0.02	0.01*
Mindfulness × Worries hypo (γ_{110})	−0.06	0.06	0.03	0.05
Mindfulness × Worries hyper (γ_{210})	0.07	0.03*	0.02	0.04

Note. $Y_{ijk} = \gamma_{000} + \gamma_{001} \times$ (child age) $+ \gamma_{002} \times$ (child gender) $+ \gamma_{003} \times$ (child diabetes duration) $+ \gamma_{010} \times$ (mindfulness) $+ \gamma_{100} \times$ (worries hypo) $+ \gamma_{110} \times$ (worries hypo) $\times$ (mindfulness) $+ \gamma_{200} \times$ (worries hyper) $+ \gamma_{210} \times$ (worries hyper) $\times$ (mindfulness) $+ r_{0jk} + r_{1jk} \times$ (worries hypo) $+ r_{2jk} \times$ (worries hyper) $+ u_{00k} + e_{ijk}$.
*$p < .05$; ***$p < .001$.

attention (i.e., mindfulness) were significantly less worried about hypoglycemia on a day level. This finding is in accordance with a recent study that found a negative association between parental mindfulness and fear of hypoglycemia (Aalders et al., 2018). Weinstein, Brown, and Ryan (2009) explained the association between mindfulness and stress reduction by showing that mindful individuals use more adaptive coping strategies and make more benign stress appraisals. The association between mindfulness and daily worries about hyperglycemia showed a trend in the same direction but failed to reach significance. As the HbA1c value of the majority of the children was within the target range (<7.5%), an existing association might have been partially masked owing to restricted range in levels of worrying about hyperglycemia. Next to experiencing less daily worries about hypoglycemia, parents with a mindful attitude also engaged in less protective behavior and hypoglycemia avoidance behavior on a daily basis. This is not surprising, given that mindfulness has been related to less negative parenting practices in the general population (Parent, Mckee, Rough, & Forehand, 2016). It is plausible to assume that parents who are focused on the present moment (mindful) are able to simultaneously pay attention to their child's current needs in addition to adequate therapy adherence, and hence demonstrate less protective behaviors. However, a post hoc analysis showed that, in the current study, parental mindfulness was not significantly associated with the HbA1c value of the child. This is in contrast with a recent study that indicated that mindfulness in the parent–child interaction is related to better glycemic control in boys with T1D and to not being hospitalized for ketoacidosis for girls (Serkel-Schrama et al., 2016). The nonsignificant association in the current study might be explained by the homogeneity of our sample, i.e., the majority of the children in our sample had adequate glycemic control (mean HbA1c = 6.87%).

Next, the finding that parental diabetes-related worries were related to more daily protective behaviors (i.e., general protective behavior and hypoglycemia avoidance behavior) is in line with interpersonal affective–motivational theories positing that distress and worries motivate parents toward behavior aimed at avoiding feared events (Goubert & Simons, 2013). Indeed, parents who strongly fear hypoglycemic events may be motivated to keep child blood glucose levels

higher than recommended to avoid hypoglycemia. Several studies confirmed positive relations between elevated parental fears of hypoglycemia and heightened child blood glucose levels (Viaene et al., 2017). The current study, however, is the first to endorse the link between worries of hypoglycemia and avoidance behavior on a daily basis. Trying to control your child and his/her condition (i.e., high levels of general protective behavior) is another way of avoiding complications. This is also in line with previous research indicating that mothers with higher levels of trait anxiety report higher involvement in T1D management and regularly keep their child home from school and social activities because of the T1D (Cameron et al., 2007). A strong drive to avoid low and high blood glucose levels, and possible consequences, may thus explain why parents with high levels of diabetes-related worries often struggle to find an adequate balance in how to support their child, e.g., between (over)protecting their child versus encouraging independence. Parenting, especially protective behavior, thus seems to be an important pathway through which elevated parental worries may impact the child with T1D, although other pathways may be possible as well, such as child modeling of parental distress (Muris, Steerneman, Merckelbach, & Meesters, 1996). Furthermore, some diabetes-related worries might be adaptive for the child's health, as it may reflect continued involvement in the diabetes care (Helgeson et al., 2012). Most adaptive may be a moderate level of worries, with very low or high levels of worries having mostly maladaptive implications. Future research should aim to determine what constitutes an adaptive level of parental diabetes-related worries.

Finally, we hypothesized that mindfulness would moderate the associations between parental worries and protective behavior. Findings only partially supported this hypothesis. In particular, it was found that mindfulness moderated the relation between parental worries about high blood glucose levels and general protective behavior. On the one hand, parents with low levels of mindfulness were persistently protective toward their child, regardless of their worries. This finding might be also applicable outside the diabetes context, in the general population (Parent, Mckee, Rough, & Forehand, 2016). On the other hand, the extent to which parents with a high level of mindfulness engaged in protective behavior was related to the extent they worried that day about hyperglycemia in their child (see Figure 1). These findings suggest that a more mindful attitude may allow parents to tailor their protective behavior on what happens on a particular day (e.g., above-target blood glucose values), which may contribute to a better glycemic control of their child. However, as only one out of four tested moderations was present, results have to be interpreted with caution.

The current research has important clinical implications. Indeed, findings indicate that parents who worry a lot about their child's T1D tend to avoid hypoglycemia and to be generally protective. This is in line with previous suggestions of research addressing associations between parental distress and protective parental behaviors (Cameron et al., 2007; Freckleton et al., 2014). Adequate hypoglycemia avoidance behavior is necessary to avoid adverse consequences of low blood sugar levels. However, exaggerated and/or consistent avoidance behaviors (e.g., keeping blood glucose levels higher than recommended) can compromise metabolic control in the long term. Likewise, general protection may have positive effects on the child's physical health, but when it exceeds a certain level and is not tailored on specific events (e.g., a hypoglycemia), it may hamper the child's adaptive development and affect his/her quality of life over time (Holmbeck et al., 2002; While et al., 2017). Furthermore, results showed that parental mindfulness is related to a reduction in daily worrying and protective behavior. This suggests that increasing parents' mindfulness levels through appropriate training programs may lower their diabetes-related worries and improve their ability to act appropriately in different diabetes-related situations.

Altogether, the current study clearly contributes to the literature, as only a few studies have yet examined mindfulness in parents of children with T1D. Furthermore, this is the first study to examine parental worries and protective parenting behavior on a daily basis, which makes it possible to examine daily fluctuations. However, several limitations can be noted, which may also provide indications for future research. First, no child outcomes were included in the present study. Future research may examine how parental mindfulness relates to child psychological well-being (e.g., quality of life). Second, daily protective parenting behaviors were solely evaluated by the parents themselves. A multi-informant approach, including child diary report, may strengthen current findings. Third, the sample was too small to examine additional (post hoc) hypotheses concerning the role of parent gender, education level, work status, etc. Future research investigating the role of these sociodemographic factors in larger samples is therefore warranted. Fourth, the current study included a large age range (4–12 years), and it is possible that the examined relations slightly differ in families with younger versus older children. However, worries are present in parents of young children, school-aged children, and adolescents with T1D (Whittemore et al., 2012) and are likely to influence parental behavior across age range. Furthermore, research in the general population

has shown that parental mindfulness is related to less negative parenting across different developmental stages (Parent et al., 2016). Fifth, the use of self-report measures includes a drawback related to social desirability. Future research may opt to use observational methods to replicate current findings. Sixth, within this study, we focused on trait mindfulness as a resilience factor, because research has suggested that trait mindfulness is associated with stress reduction, whereas state mindfulness is not (i.e., a mental state that can be elicited through meditation; Carmody, Reed, Kristeller, & Merriam, 2008). However, future research may want to examine whether mindfulness levels in parents vary from day to day. Furthermore, mindfulness is known to be conceptually different from related constructs such as emotion regulation (Feldman, Hayes, Kumar, Greeson, & Laurenceau, 2007). However, extensive empirical evidence is lacking on the similarities and differences between mindfulness and related constructs. Finally, the majority of parents was highly educated (60%) and married/cohabiting (96%), and the majority of the children had a mean HbA1c of 6.87%, which is slightly lower than the international average in young children (i.e., 7.5%, 0–10 years; Maffeis et al., 2018). This may have suppressed the strength of some associations and limit generalizability of current findings. A possible sample bias might be present, but as no sociodemographic data of the decliners were available, a comparison with decliners was not possible.

In conclusion, our findings highlight interesting daily parental dynamics, underscore the important role of parental worries in explaining daily protective behavior, and show that mindfulness may play a promising role as a resilience factor in parents of children with T1D.

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