Adolescents with type 1 diabetes (T1D) are at increased risk for depression. A history of recurrent depression (HRD) may relate to worse health outcomes than single-episode depression. However, no study has explored this issue among T1D adolescents.

**Participants and Procedure**

We examined differences in psychosocial and diabetes-related outcomes between T1D adolescents with (G1; n = 33) and without (G2; n = 18) HRD. Participants were 51 youths (aged 12-17 years) enrolled in a depression treatment study. Youths and one caregiver each completed several measures. Using MANOVA, followed by individual ANOVAs, and chi-square tests, we compared groups in continuous and categorical variables, respectively.

**Results**

MANOVA results were significant, $F(7, 43) = 3.97, p = .002$. Adolescents from G1 obtained higher scores than youths in G2 in self-esteem/guilt problems, cognitive alterations, and sadness due to T1D. Their caregivers reported more burden and rated their offspring as having more internalizing problems, facing more barriers to complying with T1D treatment, and using a medical ID less frequently than their counterparts did. A higher percentage of G1 participants presented clinical anxiety and inadequate glycemic control, and reported a history of major depression. According to caregivers, a higher proportion of G1 members had experienced multiple diabetes-related hospitalizations, were non-compliant with insulin treatment, and lived in homes with a conflictive environment.

**Conclusions**

Our study documents important differences in outcomes between T1D youths with vs. without any HRD. Clinicians may need an intensive and integrative approach to treat mental and physical aspects of health among these patients.

**Key Words**

diabetes treatment adherence; family conflict; glycemic control; mental health problems; persistent/recurrent depression
BACKGROUND

Diabetes is a chronic physical illness (CPI) linked with high comorbidity and care costs (American Diabetes Association [ADA], 2022). By 2021, high crude (16.8%) and age-adjusted (14.4%) rates of diabetes in adults (aged ≥ 18 years) from Puerto Rico (PR) were found (Centers for Disease Control and Prevention [CDC], 2023a). Based on 2019 crude estimates, about 0.35% of children under age 20 in the United States (US) had diabetes (CDC, 2022), with 244,000 out of 283,000 having type 1 diabetes (T1D). The only published study about the prevalence of diabetes in children (aged 6-16 years) from PR found a rate as high as 0.6% (Haddock & Torres de Conty, 1991). Pérez-Perdomo et al. (2005) reported a type 1/type 2 diabetes ratio of 29:1 among Puerto Rican youth. Crude (22.4%) and age-adjusted (23.9%) rates of depression among adults with diabetes (AWD) in PR exceeded those (15.3% and 14.7%, respectively) found in the general population (CDC, 2023b). Studies with T1D youths in PR showed significant depressive symptoms in 36.7% (Rivera et al., 2007), 45.5% (Rosselló & Jiménez-Chafey, 2007), and 57.5% (Rodriguez, 2006) of the cases, respectively. People with depression and diabetes have lower recovery rates and prolonged morbidity, posing a significant clinical and economic burden (Robinson et al., 2018; Sartorius, 2018).

Diabetes care imposes a significant burden on patients and their families (ADA, 2022). Given the difficulties inherent to T1D treatment in youth, a sense of overwhelming stress and uncertainty about the patient’s health may arise among family members, leading to conflicts about different issues, including diabetes self-care (Matos-Melo & Cumba-Aviles, 2018). Compliance with the treatment regimen is important to prevent short- and long-term complications. In this context, adequate care of young patients requires a team approach consisting of a primary care provider, an endocrinologist, a nurse, a dietician, and a mental health professional, as early as possible after the diagnosis and regularly thereafter (ADA, 2022). A diabetes care team could help not only to discuss psychosocial issues, reduce family conflict, promote better adaptation, and prevent medical complications but also to prevent or manage stigma and emotional problems, such as depression (Jacobson, 1996). By preventing depression, the physical health and quality of life of patients may improve, since depression is related to diabetes distress, symptom severity, insulin resistance, diabetic complications, non-adherence to treatment, inactivity, obesity, and higher mortality rates (de Groot, 2012; González et al., 2016; Moussavi et al., 2007). In addition, since complications raise the risk for depression and reduce the durability of depression treatment gain in adults, preventing or treating depression in T1D youths before complications develop is essential (Stewart et al., 2005).

Depression may show as a single-episode or recurrent course. Recurrent depression (RD) is a unipolar mood syndrome of two or more episodes separated by at least 2 months without significant mood disturbance (American Psychiatric Association, 2022). In adults with major depression (MDD) and recurrent episodes, CPIs are associated with more psychiatric admissions (Simunović-Filipčić et al., 2019). Spanish adults with RD had higher rates of CPIs than those with single episodes; RD was related to a 30% increased odds of diabetes (Gill et al., 2011).

According to Robinson et al. (2018), “episodes of depression in individuals with diabetes are likely to last longer and have a higher chance of recurrence compared to those without diabetes” (p. S131). Ceretta et al. (2012) and Maraldi et al. (2007) reported a twofold increase in the odds for RD among AWD compared to controls. In AWD and multiple depressive episodes, recovery time was shorter with each successive episode (de Groot et al., 2016). About 21 studies have reported rates of RD in depressed AWD (Bruce et al., 2006; Ceretta et al., 2012; de Groot et al., 2015, 2016; Fisher et al., 2008; Janssen et al., 2021; Jung et al., 2021; Katon et al., 2004; Lloyd et al., 2018; Lustman et al., 1988, 1997; Maraldi et al., 2007; Nefs et al., 2012; Nobis et al., 2015; Peyrot & Rubin, 1999; Schmitz et al., 2014; van Bastelaar et al., 2012; van Dooren et al., 2016; Wagner et al., 2009; Whitworth et al., 2017; Wu et al., 2020). Among those studies, rates of RD were from 10.27% (van Bastelaar et al., 2012) to 92% (Lustman et al., 1997), the latter within a 5-year follow-up. AWD depressed at intake and not seeking treatment had an average of 4.2 additional episodes within 5 years (Lustman et al., 1988). Consistent with Nefs et al. (2012), RD rates were similar for type 1 (T1D) or type 2 diabetes (T2D). Within the same period, the average number of episodes in AWD seeking treatment was 4.8 (Lustman et al., 1997).

The overall exposure to depression in AWD contributes to negative psychiatric and medical outcomes (de Groot et al., 2016). Either if present as a disorder or as discrete episodes of elevated depressive symptoms, correlates of RD in AWD include more diabetic complications, comorbid medical conditions, increased complexity of diabetes treatment, more severe depression at intake, incomplete remission after treatment, higher body mass index (BMI), reduced quality of life or functionality, worse glycemic control, death by suicide or other unnatural cause, increased risk for all-cause mortality, increased use of diabetes-related services and antidepressants, and decreased satisfaction with antidepressants (Bobrov et al., 2021; Ceretta et al., 2012; de Groot et al., 2015, 2016; Deschênes et al., 2017; Fisher et al., 2008; Janssen et al., 2021; Jung et al., 2021; Lustman et al., 1988, 1997, 2007; Maraldi et al., 2007; Schmitz et al., 2014; Wagner et al., 2009; Whitworth et al., 2017; Wu et al., 2020). Among AWD, a history of MDD was related to
a sixfold increase in the risk of recurrent depressive symptoms (Whitworth et al., 2017).

Several studies have examined the relationship between RD and demographics in AWD. Some of them did not find sex differences in rates of RD (Lustman et al., 2006; Nefs et al., 2012). However, Fisher et al. (2008) and Whitworth et al. (2017) found that being a woman was related to the recurrence of depressive symptoms. Two studies found that diabetes duration was unrelated to RD (Fisher et al., 2008; Nefs et al., 2012). Fisher et al. (2008) reported that ethnicity and education level were unrelated to the recurrence of MDD or depressive symptoms, but that younger age was associated with a more frequent occurrence of both. Whitworth et al. (2017) also reported that younger age was related to recurrent depressive symptoms. In antidepressant maintenance trials, younger age predicted RD (Lustman et al., 2007; Williams et al., 2007).

Among depressed youth without diabetes, some demographics have been related to RD. Several studies have shown higher rates of RD among girls (Birmaher et al., 2004; Curry et al., 2011; Dunn & Goodyer, 2006; Hamlat et al., 2020; Lewinsohn et al., 1994, 2000), but others have contradicted these findings (Emslie et al., 1997; Kiviruusu et al., 2020; Kovacs et al., 1984; Rao et al., 1995; Warner et al., 1992). Although some studies found an association between RD and older age in adolescents (Dunn & Goodyer, 2006; Emslie et al., 1997), others found age to be unrelated to RD (Curry et al., 2011; Rao et al., 1995; Warner et al., 1992) and one study reported that younger age was related to RD (Kiviruusu et al., 2020). Two studies have reported an association between RD and lower socioeconomic status (Melvin et al., 2013; Rao et al., 1995), but another study did not (Curry et al., 2011). No association has been reported between race/ethnicity and RD in youths (Curry et al., 2011; Emslie et al., 1997; Rao et al., 1995).

Diverse psychosocial and clinical history factors have been related to RD in adolescents without diabetes. These include the severity of and comorbidity at the index episode, comorbid anxiety, suicide ideation/behavior, family conflict, comorbid dysthymia, lower self-efficacy for depression, family history of recurrent MDD, parental history of MDD, personal history of minor depression, lower global and social functioning, problems with spare-time activities, lower social support, interpersonal stress, psychotic symptoms, dissatisfaction with life, poor self-regulation of sadness, as well as lower global self-worth and more negative cognitions (Birmaher et al., 2004; Curry et al., 2011; Dunn & Goodyer, 2006; Emslie et al., 1997; Hammen, 2009; Hammen et al., 2008; Kovacs et al., 1984, 2016; Lewinsohn et al., 1994, 1999, 2000; Melvin et al., 2013; Peters et al., 2016; Pettit et al., 2013; Rao et al., 1995, 2010; Warner et al., 1992). Also, early onset (< 15 years old) RD relates to higher rates of chronic and severe depression at ages 15-20 and poorer interpersonal outcomes at age 20 (Hammen et al., 2008).

T1D youths are at increased risk for depression compared with controls (Cumba-Aviles & Sáez-Santiago, 2016). Although it has been hypothesized that RD may relate to reduced treatment adherence and glycemic control in youths, no study has examined this issue. The first study on RD rates in T1D youth found that 32% to 46% had recurrent episodes at 2-year and 6.5-year follow-ups, respectively (Kovacs et al., 1997). RD rates were similar among T1D youths and depressed psychiatric controls, although the former were less likely to have had extended depression-free periods. In that study, being a girl predicted RD among youths with T1D, but not social class, psychiatric comorbidity or the age of recovery of the previous depressive episode. Insabella et al. (2007) followed T1D adolescents (aged 12-20) during a 5-year period and reported that 23.5% of those with high depression symptoms at intake were depressed again at the last follow-up. Among T2D youth who presented significant depressive symptoms within a 2-year follow-up, 43.44% were depressed in at least 2 out of 3 assessments (Van Buren et al., 2018). However, symptom recurrence was unrelated to glycemic control. Studies on the rate of RD among depressed adolescents without diabetes are more common, yielding rates from 16.1% (Warner et al., 1992) to 61% (Emslie et al., 1997) among clinical samples in up to 5-year follow-up periods. Rates of recurrence within follow-up periods of 8, 12, and 20 years were 67% (Kiviruusu et al., 2020), 72.88% (Pettit et al., 2013), and 75.2% (Fombonne et al., 2001), respectively.

Findings from studies on AWD and depressed youths with or without diabetes suggest that a history of recurrent depression (HRD) may worsen health-related and psychosocial outcomes more deeply than single-episode depression. However, no study has thoroughly examined its psychosocial or diabetes-related correlates among youths with T1D. In this study, we examined differences in both domains among T1D adolescents with (Group 1; n = 33) and without (Group 2; n = 18) any HRD. We hypothesized that youth with any HRD will show worse outcomes than their counterparts in diabetes-related and psychosocial domains.

**PARTICIPANTS AND PROCEDURE**

**PARTICIPANTS**

Participants were 51 T1D youths (29 girls) aged 12-17 years (M = 15.26, SD = 1.60) recruited for a depression treatment study from which data we conducted secondary analyses. They attended public (66.67%) or private schools. About 43.14% lived in the San Juan Metropolitan Area. Their mean Children’s Depression Inventory (CDI) score was 19.53. The mean glycosylated hemoglobin result obtained from their private laboratory tests before enrollment
was 9.14 (SD = 2.25; range = 5.76-17.70). The mean T1D duration was 6.12 years (SD = 3.88). Ten (19.61%) youths were using an insulin pump at intake. The mean household size was 4.02 members (SD = 0.95). About 86.27% of caregivers were women. Their mean age was 43.45 years (SD = 6.59). Most families (72.55%) were of lower-middle/low socioeconomic status with a mean annual income (in U.S. dollars) of $37,024.42 (SD = 3,837.64). Twenty of them (39.22%) lived under U.S. poverty levels.

For inclusion in the main study, youths had to be 12-17 years old, obtain a CDI score ≥ 13 or a score ≥ 44 in the Children’s Depression Rating Scale-Revised, and be willing to attend weekly cognitive-behavioral group psychotherapy sessions (conducted by clinical psychology graduate students). History of psychotic symptoms, bipolar disorder, last-year substance dependence/abuse, imminent suicide risk, concurrent depression treatment, current child maltreatment/abuse, and having a non-depressive disorder that was in primary need of intervention were exclusion criteria (Cumba-Aviles & Sáez-Santiago, 2016).

MEASURES

Sociodemographic data form. Besides sociodemographic data on youths and caregivers, the latter provided data on perceived socioeconomic status (SES), history of mental health treatment, T1D duration, and comorbid CPIs. Youths provided data on their height and weight to compute BMI.

Diagnostic Interview Schedule for Children-IV (DISC-IV) – Spanish version. The DISC-IV assesses DSM criteria for several mental disorders in youths. Its Spanish version has adequate reliability in PR (Bravo et al., 2001) and has been successfully used in clinical samples of depressed youths and their parents (Bernal et al., 2019). Caregivers and youths in our sample completed the MDD module at intake. Although designed for a DSM-IV diagnosis, we asked additional questions (when needed) to ensure the assessment of DSM-5 criteria.

MINI International Neuropsychiatric Interview-Spanish 6.0 (kid and adult versions). The MINI assesses the criteria for the most common mental disorders in children (Sheehan et al., 2010) and adults (Sheehan et al., 1998). We used the MDD module from each version and other relevant information needed for differential diagnosis. Although designed for DSM-IV criteria, we also asked questions (when needed) to ensure the assessment of DSM-5 criteria.

Beck Anxiety Inventory (BAI). This 21-item anxiety measure has been used with adults and adolescents (Beck & Steer, 1993). In this sample, its α value was .86 (Morales-Espada et al., 2016). Scores ≥ 8, ≥ 16, and ≥ 26 indicate mild, moderate, or severe anxiety symptoms, respectively.

Undervaluing/Self-reproach and Cognitive Alterations Scale. This scale contains two subscales from the Depressive Symptom Spectrum Assessment Inventory (Cumba-Aviles & Feliciano-López, 2013). Its α value for T1D youth is .87 for the 12-item Undervaluing/Self-reproach (self-esteem/guilt) and .90 for the 10-item Cognitive Alterations subscale (Matos-Melo & Cumba-Aviles, 2016).

Child Behavior Checklist/4-18 (CBCL/4-18). This measure has been widely used in PR (Achenbach, 1991). We used the Internalizing scale, whose α value in this sample was .84 (Muñoz-Reyes et al., 2017).

Burden Assessment Scale (BAS). This scale assesses the burden of caring for people with a mental illness (Matías-Carrerlo et al., 2003). Its α value in this sample was .90 (Rodríguez-Beato et al., 2018).

Family conflict. To classify cases with regard to the presence/absence of family conflict at home, we asked caregivers to rate the following statements: “We fight a lot (not physically)” and “We rarely become openly angry”. If the first item was rated as true and/or the second was rated as false, we coded family conflict as 1 (present). Otherwise, we coded conflict as 0 (absent).

Barriers to Adherence Questionnaire (BAQ). The BAQ assesses the frequency of cognitive and environmental obstacles to adherence (self-care) in people with diabetes (Glasgow et al., 1987). Its 20 items are rated on a frequency scale from 0 (never or rarely) to 6 (every day). We used a parent-rated Spanish version. In this sample, its internal consistency was .80 (Piñero-Meléndez et al., 2016).

Glycosylated hemoglobin (HbA1c). Qualified personnel conducted HbA1c tests at lab facilities from the University of Puerto Rico, Medical Sciences Campus. We used the latter for the analysis of glycemic control included in the Results section.

Kovacs-Diabetes Management Information Sheet (K-DMIS). Through the K-DMIS (Kovacs et al., 1986), we collected from parents T1D-related information, including youth’s non-compliance with insulin treatment (past 3 months), medical identification (ID) use, sadness due to T1D, type of treatment (i.e., insulin pump or multiple daily injections), and number of lifetime diabetes-related hospitalizations.

PROCEDURE

Institutional review boards from two university campuses (Rio Piedras Campus approval no. 1112-005 and Medical Sciences Campus approval no. A9530112) approved the study. Study procedures were in accordance with the Helsinki Declaration of 1975, as revised in 2000. We shared information on the main study via T1D clinics, local media, and printed materials. We recruited youths through summer camps, educational and recreational activities, and referrals from endocrinologists, school personnel, and other
participants. Caregivers completed requests for participation forms by phone. We invited youths and one parent each to an in-person screening if they met the initial eligibility criteria. After consent/assent, they completed some of the measures at this visit and other instruments during a mental health diagnostic evaluation scheduled within 2 weeks. Data collected through the DISC-IV and the MINI, including questions to assess the clinical history of depressive disorders and symptoms (e.g., age of onset, number of episodes, and duration of symptom-free periods) were used to establish the recurrence of depression. Youths were classified into Group 1 (G1) if criteria for a history of recurrent depressive disorder or recurrent depressive symptoms were confirmed either by self-report and/or caregiver’s report.

DATA ANALYSIS

We used SPSS 27.0 for all statistical analyses. After classifying the sample between youths with vs. without any HRD, we used chi-square and Student’s $t$-tests for comparing groups in categorical and continuous sociodemographic variables. Then, we conducted a multivariate analysis of variance (MANOVA), followed by individual analyses of variance (ANOVAs) to compare group means for the continuous dependent variables, considering their HRD status. For comparing groups in categorical dependent variables, we used chi-square tests. We assessed all group comparisons using the criterion of $p \leq .05$. We used the partial eta squared ($\eta^2_p$) indicator provided in the MANOVA/ANOVA analyses and calculated Cohen’s $d$ to estimate the effect size of mean differences in continuous variables. To assess the effect size of differences between groups in categorical outcome variables, we estimated Cohen’s $d$ and $\eta^2_p$ based on a chi-square transformation (for a 2 x 2 cross-tab), following the formula provided by DeFife (2009).

RESULTS

We found no group differences in sociodemographic variables (Table 1). Therefore, we did not need to control for their effects in subsequent analyses. Groups were similar even in the proportion of cases with a history of mental health treatment, comorbid CPIs, or using insulin pumps, as well as in their diabetes duration and their BMI.

Table 1

**Sociodemographic variables by depression recurrence status**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Recurrent $(n = 33)$</th>
<th>Single episode $(n = 18)$</th>
<th>$\chi^2/t$</th>
<th>$d$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Categorical variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adolescent’s sex (Girls)</td>
<td>51.52% (17)</td>
<td>66.67% (12)</td>
<td>1.09</td>
<td>0.30</td>
</tr>
<tr>
<td>School attended (Public)</td>
<td>69.70% (23)</td>
<td>61.11% (11)</td>
<td>0.39</td>
<td>0.18</td>
</tr>
<tr>
<td>Metropolitan zone (Yes)</td>
<td>48.48% (16)</td>
<td>33.33% (6)</td>
<td>1.09</td>
<td>0.30</td>
</tr>
<tr>
<td>Rural vs. urban (Rural)</td>
<td>27.27% (9)</td>
<td>44.44% (8)</td>
<td>1.55</td>
<td>0.35</td>
</tr>
<tr>
<td>SES (lower-middle/low)</td>
<td>78.79% (26)</td>
<td>61.11% (11)</td>
<td>1.83</td>
<td>0.39</td>
</tr>
<tr>
<td>Two-parent home (Yes)</td>
<td>48.48% (16)</td>
<td>38.89% (7)</td>
<td>0.43</td>
<td>0.19</td>
</tr>
<tr>
<td>Mental health Tx (Yes)</td>
<td>69.70% (23)</td>
<td>72.22% (13)</td>
<td>0.04</td>
<td>0.05</td>
</tr>
<tr>
<td>Comorbid CPI (Yes)</td>
<td>51.52% (17)</td>
<td>44.44% (8)</td>
<td>0.23</td>
<td>0.14</td>
</tr>
<tr>
<td>Insulin pump (Yes)</td>
<td>21.21% (7)</td>
<td>16.67% (3)</td>
<td>0.15</td>
<td>0.11</td>
</tr>
<tr>
<td><strong>Continuous variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adolescent’s age</td>
<td>15.45 (1.70)</td>
<td>14.91 (1.39)</td>
<td>1.14</td>
<td>0.33</td>
</tr>
<tr>
<td>T1D duration</td>
<td>6.42 (3.66)</td>
<td>5.56 (4.31)</td>
<td>0.76</td>
<td>0.22</td>
</tr>
<tr>
<td>Body mass index</td>
<td>22.52 (5.37)</td>
<td>20.24 (3.77)</td>
<td>1.59</td>
<td>0.47</td>
</tr>
<tr>
<td>Caregiver’s age</td>
<td>43.42 (6.64)</td>
<td>43.50 (6.69)</td>
<td>–0.04</td>
<td>0.01</td>
</tr>
<tr>
<td>Caregiver’s education</td>
<td>14.67 (1.87)</td>
<td>14.56 (3.38)</td>
<td>0.15</td>
<td>0.04</td>
</tr>
<tr>
<td>Annual family income</td>
<td>$35,521.98 (25,061.96)</td>
<td>$39,778.89 (31,849.51)</td>
<td>–0.53</td>
<td>0.15</td>
</tr>
<tr>
<td>Household size</td>
<td>3.91 (0.80)</td>
<td>4.22 (1.17)</td>
<td>–1.13</td>
<td>0.33</td>
</tr>
</tbody>
</table>

Note. Cohen’s $d$ values within intervals in parentheses are considered as small (0.20-0.49), medium (0.50-0.79), and large (0.80 and above); CPI – chronic physical illness; Tx – treatment; T1D – type 1 diabetes; SES – perceived socio-economic status.
The MANOVA that examined continuous variables by HRD status was significant \( F(7, 43) = 3.97, \ p = .002; \) multivariate effect size \( = .39 \). Individual ANOVAs showed that youth in G1 had significantly more self-esteem/guilt problems and cognitive alterations than youth in G2. The caregivers of G1 members indicated that their children had more internalizing problems, showed more sadness due to T1D, and faced more barriers to complying with T1D treatment (Table 2). Caregivers of G1 members also indicated that their offspring used a diabetes medical ID less frequently than reported by caregivers of G2 members. Parents of youth with any HRD also reported a higher caregiver burden mean score. The effect sizes of these differences were medium in all cases, except for medical ID, which reflected a large effect.

When comparing groups in categorical outcomes, we found that a significantly higher proportion of G1 members had two or more hospitalizations in their lifetime due to T1D, inadequate glycemic control, and non-compliance with insulin treatment in the past 3 months. In addition, youth in G1 were more likely to have mild to severe anxiety levels, to have a lifetime or a past-year history of MDD, or to live in households in which family conflict was present. Effect sizes for such differences were mostly medium but large for family conflict. As regards youths’ lifetime history of suicidality or chronic depressive symptoms (that is, lasting ≥ 1 year), as well as caregivers’ history of MDD, rates of occurrence were not significantly different between groups.

**DISCUSSION**

We examined differences in psychosocial and diabetes-related outcomes between T1D adolescents with (G1) and without (G2) any HRD. As reported for AWD (de Groot et al., 2015, 2016; Lustman et al., 2006; Schmitz et al., 2014; Wu et al., 2020), we found worse

### Table 2

**Group comparison in outcome variables by depression recurrence status**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Recurrent ((n = 33))</th>
<th>Single episode ((n = 18))</th>
<th>(F/\chi^2)</th>
<th>(\eta^2)</th>
<th>(d)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Continuous outcome variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-esteem/Guilt problems</td>
<td>6.70 (6.04)</td>
<td>3.39 (3.70)</td>
<td>6.87*</td>
<td>0.12</td>
<td>0.78</td>
</tr>
<tr>
<td>Cognitive alterations</td>
<td>7.97 (6.21)</td>
<td>4.22 (4.35)</td>
<td>6.34*</td>
<td>0.12</td>
<td>0.75</td>
</tr>
<tr>
<td>Internalizing problems</td>
<td>17.58 (7.65)</td>
<td>13.11 (7.07)</td>
<td>4.18*</td>
<td>0.08</td>
<td>0.60</td>
</tr>
<tr>
<td>Sadness due to T1D</td>
<td>1.85 (1.28)</td>
<td>1.06 (1.30)</td>
<td>4.42*</td>
<td>0.08</td>
<td>0.61</td>
</tr>
<tr>
<td>Caregiver’s burden</td>
<td>58.67 (12.71)</td>
<td>50.56 (14.71)</td>
<td>4.24*</td>
<td>0.08</td>
<td>0.60</td>
</tr>
<tr>
<td>Medical ID use</td>
<td>2.09 (1.18)</td>
<td>3.11 (1.18)</td>
<td>8.67**</td>
<td>0.15</td>
<td>0.86</td>
</tr>
<tr>
<td>Barriers to T1D adherence</td>
<td>51.12 (17.37)</td>
<td>36.11 (21.38)</td>
<td>7.38**</td>
<td>0.13</td>
<td>0.79</td>
</tr>
<tr>
<td><strong>Categorical outcome variables</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two or more T1D hospitalizations</td>
<td>72.73% (24)</td>
<td>38.89% (7)</td>
<td>5.59*</td>
<td>0.11</td>
<td>0.70</td>
</tr>
<tr>
<td>Insulin non-compliance events</td>
<td>57.58% (19)</td>
<td>22.22% (4)</td>
<td>5.88*</td>
<td>0.12</td>
<td>0.72</td>
</tr>
<tr>
<td>HbA1c (% inadequate control)</td>
<td>45.45% (15)</td>
<td>16.67% (3)</td>
<td>4.23*</td>
<td>0.08</td>
<td>0.60</td>
</tr>
<tr>
<td>Mild to severe anxiety (Yes)</td>
<td>72.73% (24)</td>
<td>44.44% (8)</td>
<td>3.99*</td>
<td>0.08</td>
<td>0.58</td>
</tr>
<tr>
<td>Youth-reported MDD (Past year)</td>
<td>48.48% (16)</td>
<td>16.67% (3)</td>
<td>5.04*</td>
<td>0.10</td>
<td>0.66</td>
</tr>
<tr>
<td>Youth-reported MDD (Lifetime)</td>
<td>57.58% (19)</td>
<td>22.22% (4)</td>
<td>5.88*</td>
<td>0.12</td>
<td>0.72</td>
</tr>
<tr>
<td>History of suicidality (Youth)</td>
<td>75.76% (25)</td>
<td>55.56% (10)</td>
<td>2.21</td>
<td>0.04</td>
<td>0.43</td>
</tr>
<tr>
<td>Chronic depressive symptoms (Yes)</td>
<td>36.36% (12)</td>
<td>27.78% (5)</td>
<td>0.39</td>
<td>0.01</td>
<td>0.18</td>
</tr>
<tr>
<td>Parental history of MDD (Lifetime)</td>
<td>63.64% (21)</td>
<td>44.44% (8)</td>
<td>1.75</td>
<td>0.03</td>
<td>0.38</td>
</tr>
<tr>
<td>Parent-rated family conflict (Yes)</td>
<td>81.82% (27)</td>
<td>44.44% (8)</td>
<td>7.56**</td>
<td>0.15</td>
<td>0.83</td>
</tr>
</tbody>
</table>

*Note. \(\eta^2\) values within intervals in parentheses are considered as small (0.01-0.05), medium (0.06-0.13), and large (0.14 and above); Cohen’s \(d\) values within intervals in parentheses are considered as small (0.20-0.49), medium (0.50-0.79), and large (0.80 and above). Inadequate control – HbA1c of 9.50 or higher; T1D – type 1 diabetes; ID – identification; HbA1c – glycosylated hemoglobin; MDD – major depressive disorder; *\(p \leq .05\), **\(p \leq .01\).
psychosocial and diabetes-related outcomes among G1 members, which supported our hypothesis. Mental health outcomes in G1 included more cognitive and self-esteem/guilt problems, higher rates of clinical anxiety, and more severe internalizing problems (i.e., somatic, depressive, anxious, and withdrawal symptoms). These results are consistent with reports of studies with non-T1D youths (Curry et al., 2011; Dunn & Goodyer, 2006; Emelie et al., 1997; Hammen et al., 2008; Kovacs et al., 2016; Lewinsohn et al., 1999; Warner et al., 1992). Furthermore, following findings from Whitworth et al. (2017) among AWD, we observed that youths with RD had a higher rate of last-year and lifetime history of MDD. We also found that RD was associated with more severe sadness in youths, specifically related to having T1D. In fact, our study is the first to document the association of RD with worse mental health outcomes of any kind among T1D youth.

The higher proportion of G1 (HRD) cases with youth-reported MDD and/or significant anxiety is consistent with caregivers’ reports of more internalizing problems in this group. Such results, along with those about self-esteem/guilt problems and cognitive alterations, suggest that having any HRD might pose a perfect storm of comorbid emotional and cognitive problems for these youths. Thus, it is not surprising that caregivers of G1 members experimented higher burden levels associated with caring for their children and that a higher proportion reported a conflictive environment at home. Our finding establishing a link between family conflict and RD is consistent with studies of adolescents without diabetes (Hammen et al., 2008; Lewinsohn et al., 2000) but also the first report of that relationship among T1D youths. This research is also the first to document significant differences in caregivers’ burden, with higher scores for the HRD group, among patients with diabetes of any age or racial/ethnic background.

We found that no sociodemographic variable was related to RD. Contrary to previous findings in T1D youths (Kovacs et al., 1997), RD did not relate to the child’s sex in our sample. Precisely, studies conducted with depressed adolescents without diabetes and AWD have yielded inconsistent results about sex differences in that area. The same pattern of findings applies to SES. On the other hand, our findings about diabetes duration and education level are consistent with previous reports of a lack of relationship with RD. Regarding age, the association of younger age with RD has been reported among AWD but not among youth.

We did not find an association between RD and a history of chronic depressive symptoms. Our result is contrary to studies reporting that dysthymia was related to RD in youth (Kovacs et al., 1984; Warner et al., 1992). This may be due, in part, to the fact that, in the main study from which we drew our data, assessments about dysthymia focused on the 2-year period before intake, while questions about MDD or minor depression addressed a lifetime period.

Our study contributes to the research literature by considering correlates of any HRD not previously examined among adolescents, particularly among those with diabetes. Some of the correlates are related to diminished adherence to T1D treatment. On the one hand, this study is the first to show the association of any HRD with increased difficulties complying with diabetes self-care (i.e., insulin treatment or wearing a medical ID) or with a higher rate of multiple diabetes-related hospitalizations in youths with diabetes. The latter finding is consistent with the observed increased use of diabetes-related services (Whitworth et al., 2017) and more diabetes-related complications (Bobrov et al., 2021; de Groot et al., 2016; Deschénes et al., 2017; Lustman et al., 1997; Wu et al., 2020) among AWD and RD. On the other hand, our finding of a higher rate of inadequate glycemic control among G1 (HRD) cases is also in line with reports from studies with depressed AWD (Ceretta et al., 2012; Fisher et al., 2008; Lustman et al., 1988, 1997; Maraldi et al., 2007) but opposed to Van Buren et al.’s (2018) findings with T2D youths.

LIMITATIONS

This study has several limitations. First, our sample size reduced the statistical power to detect potentially significant differences among groups (e.g., in youths’ suicidality and parental history of depression). Second, our cross-sectional design precludes examining causal relationships among variables. Longitudinal studies with adequate sample sizes should be conducted to further examine rates of RD among T1D youths and its temporal association with candidate correlates. Third, our family conflict measure was limited to caregivers’ overall conflict assessment. Future studies should include a diabetes-specific conflict measure and examine adolescents’ ratings of such conflict. Finally, the histories of psychiatric admissions and antidepressant medication were not systematically assessed in our sample, precluding their examination as potential RD correlates.

IMPLICATIONS AND FUTURE DIRECTIONS

Understanding the course of depression in people with diabetes has implications for treatment and standards of care (de Groot et al., 2016). In Lustman et al.’s (1997) study, even among AWD responsive to antidepressant medication, a reemergence of MDD occurred in as many as 60% of patients within a year, if pharmacotherapy was discontinued. Continuation of antidepressant medication beyond depression re-
mission reduces the risks of both relapse and recurrence (DeRubeis et al., 2020). This protection against RD has also been observed in AWD (Lustman et al., 2006, 2007; Williams et al., 2007). In youths, cognitive-behavioral therapy (CBT) in combination with antidepressants reduces the risk for relapse by eightfold compared with pharmacotherapy alone (Kendall et al., 2008). Considering these findings, RD may require combined treatments, maintenance psychotherapy and/or pharmacotherapy, and primary care assessment protocols that explore past episodes more deeply and not only current symptoms (Katon et al., 2009; Williams et al., 2007). Adequate medical treatment also plays an essential role in preventing RD (Lustman et al., 1997; Sartorius et al., 2018).

Clinicians might need a more intensive, integrative, and interdisciplinary approach to treat mental and physical aspects of health among the subgroup of patients with diabetes and RD. The standards of medical care in diabetes (ADA, 2022) establish that “adult patients with a history of depressive symptoms need ongoing monitoring of depression recurrence within the context of routine care” (p. S73). The rates of RD observed in adolescent studies (including 64.71% of cases with RD in the current sample) suggest that this standard should also be applied to T1D youths. According to Lustman et al. (1997), “each episode of depression in diabetes should be treated aggressively to the point of complete remission” (p. 142). As some psychosocial correlates of RD identified in our sample of T1D Hispanics youths tend to persist in time (e.g., family conflict and caregiver’s burden), the integration of caregivers (and family members) into treatment, as well as the inclusion of booster or maintenance sessions in treatment protocols, may be required in many cases (Bernal et al., 2019; Cumba-Aviles & Saez-Santiago, 2016). In addition, an integrated strategy to target depressive and anxious symptoms simultaneously may be needed when applying psychotherapy (such as CBT) with this group of patients, alone or in combination with pharmacotherapy, as reducing comorbid anxiety may help to prevent relapse and/or recurrence. In general, further studies should examine the role of RD in moderating or predicting gains in interventions to reduce depression and/or improve glycemic control among T1D adolescents. Within its limitations, this study represents an initial and significant contribution to research on the correlates of RD in youths with T1D.

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