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ISSN / eISSN **0882-5963**
Publisher **ELSEVIER SCIENCE INC, STE 800, 230 PARK AVE, NEW YORK, USA, NY, 10169**

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Journal Website	⧉ Visit Site	**Publisher Website**	⧉ Visit Site
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Issues Per Year	6	**Country / Region**	UNITED STATES OF AMERICA
Primary Language	English		

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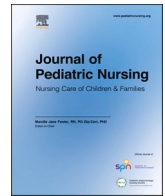| JCI Category	Category Rank	Category Quartile
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The Turkish version of the problem areas in diabetes-parents of teens (P-PAID-T): Cross-cultural adaptation, reliability, and validity

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ARTICLE INFO

ABSTRACT

Objective: To examine the Turkish validity and reliability of the Problem Areas in Diabetes- Parents of Teens (P-PAID-T) scale and its psychometric properties for determining the parents' diabetes-related distress.

Methods: The study included the parents of 200 adolescents with T1DM for at least a year. P-PAID-T and a demographic data form were used for data collection. Davis technique was used for the content validity of the scale. The scale's reliability was tested using test-retest, and its internal reliability was analyzed with Cronbach's alpha test. Exploratory Factor Analysis (EFA) was used to analyze the factor structure. Confirmatory Factor Analysis (CFA) was used to evaluate the fit of the scale.

Results: 69.5% ($n = 139$) of the participants were mothers. Compared to the fathers, the mothers' mean P-PAID-T score was significantly higher. Parents of sons, who used insulin injections for their children, and had a college degree or higher education level had higher P-PAID-T scores. The test-retest correlation coefficient of the scale was 0.977. The Cronbach α value of the scale was 0.901. The results of confirmatory factor analysis were $x2/df = 2.931$, GFI = 0.736, CFI = 0.711, NFI = 0.628, NNFI = 0.660, RMSEA = 0.141.

Conclusion: The Turkish version of P-PAID-T was a valid and reliable screening tool for measuring diabetes stress in parents of adolescents with T1DM.

Practice implications: Nurses could use the Turkish version of P-PAID-T to monitor parental diabetes distress and organize interventions; also Turkish P-PAID-T could facilitate research on diabetes distress for parents of adolescents with T1DM.

Introduction

One of the most prevalent chronic diseases in children and adolescents, Type 1 diabetes mellitus (T1DM) is an autoimmune condition that requires lifelong insulin administration (Iturralde et al., 2017). Estimates suggest that around 100,000 children are developed T1DM each year and the prevalence of the disease is rising gradually (Patterson et al., 2019). The incidence of T1DM is affected by variables such as race, and ethnicity, and varies worldwide. For example, in the United States, the annual incidence of T1DM in children has been reported to be 22.3 per 100,000 overall (Divers et al., 2020). For Turkey, researchers

reported that the prevalence and incidence of T1DM under the age of twenty were 0.75/1000 and 10.8/100,000, respectively. Also, according to them, Turkey accounts for approximately 3% of T1DM cases worldwide (Yeşilkaya et al., 2017). Due to the chronic course of the disease and a strict treatment regimen that requires frequent insulin injections, blood glucose monitoring, regular physical activity, and dietary compliance, managing T1DM is quite challenging for both adolescents and their parents and causes a psychosocial burden (Raymond, 2015).

Parents play an important role in managing and monitoring their children's daily tasks related to the complex treatment regimen of T1DM (Zysberg & Lang, 2015). Psychologically, when their child is first

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diagnosed, parents may be confused about integrating these new responsibilities into their family's routine and may experience self-doubt or show feelings of guilt and anxiety (Lawton et al., 2015). The main goal of T1DM treatment is to maintain steady blood sugar levels. Additionally, it requires minimizing the occurrence of potentially severe hypoglycemic events and preventing long-term complications of diabetes. All these responsibilities cause serious psychosocial, emotional, and financial stress on parents (Rewers et al., 2014). Many studies have shown that parents, especially mothers, of a child with diabetes develop higher levels of depression and anxiety symptoms, which can lead to difficulties in coping with diabetes (Bassi et al., 2020). In a study using semi-structured interviews, parents reported that emotional burden is the hardest part of managing their children's diabetes (Commissariat et al., 2020). In support of earlier studies, a large-sample multi-center study conducted in Germany revealed that emotional burden was the most prevalent type of burden experienced by parents and that worries about long-term and future complications primarily brought on the emotional burden in parents. The same study found that mothers had more emotional burdens than fathers, and HbA1c level was the only predictor of emotional stress in parents regardless of gender (Saßmann et al., 2022).

Family involvement in the treatment process has been associated with increased adherence to treatment and improved glycemic control (Markowitz et al., 2012). Parental stress, however, has been associated with lower glycemic control, worse perceptions of parental involvement and effectiveness in diabetes management tasks, higher parental fear of hypoglycemia, and elevated depressive symptoms in both parents and adolescents (Evans et al., 2019). Further, reduced parental well-being and stress were associated with increased mental health problems and poor glycemic control in children with diabetes. (Eilander et al., 2017). On the other hand, parental stress may also positively impact diabetes management. For example, Pedersen et al. (2019) found a family environment with responsive, constructive, and problem-solving-oriented relationships and supportive parental behaviors was directly related to decreased HbA1c levels in adolescents with T1DM (Pedersen et al., 2019).

Parents are more likely to experience additional psychological burdens and have difficulty navigating daily life functions when healthcare professionals fail to recognize early signs of distress (Castensøe-Seidenfaden et al., 2017). To help both parents adjust to the process as caregivers and to achieve optimal health outcomes for children, it is important to identify the areas where parents struggle and to improve these areas through clinical and social interventions. Instead of using particular scales measuring diabetes-specific emotional distress in parents and children, general psychological functioning (Wiebe et al., 2011) or depressive symptoms (Jaser et al., 2017) questionnaires were frequently utilized in studies on diabetes stress. Although these scales are helpful, certain stress factors related to having diabetes are not fully addressed by them (experiencing distress in hypo- or hyperglycemic conditions, difficulty in performing tasks related to diabetes management, etc.). Evaluating diabetes-related problems rather than general stressors is valuable because it can make research and clinical studies more focused. Nonetheless, the number of standardized scales created for usage in this discipline is very small. The 15-item Problem Areas in Diabetes-Parents of Teens (P-PAID-T) scale developed by Shapiro et al. (2018) is one of the standardized and well-measured tools for diabetes-related stress in parents. Although this scale has been used to measure parental diabetes stress in studies (Vesco et al., 2018; Von Sengbusch et al., 2022), its validity and reliability in other languages have not been examined yet, except for the very recent German translation (Saßmann et al., 2023).

Researchers and clinicians need reliable measurement tools validated in their own cultures and languages to conduct cross-cultural studies and stay focused on studies in different populations for the best benefit of patients, which makes the adaptation, validity, and reliability studies of the assessment instruments that can be useful in clinical practice quite valuable (Sousa & Rojjanasrirat, 2011). In Turkey, there is not yet a scale developed in Turkish to measure emotional stress in parents with children with diabetes. So, in this study, we aimed to adapt the 15-item English version of the P-PAID-T scale to Turkish to assess the scale's validity, reliability, and psychometric properties as a tool for Turkish clinicians measuring diabetes-related distress in parents of adolescents with T1DM. It is obvious that the adaptation of a scale that will enable a quick and well assessment of the stress experienced by parents will be instrumental given the large number of children with T1DM and their families in our country.

Material and methods

Participants and data recruitment

Parents of adolescents aged 11–18 years diagnosed with T1DM for at least 1 year who were admitted to the pediatric endocrinology outpatient clinic for follow-up or hospitalized in the pediatric endocrinology service of Sivas Cumhuriyet University Hospital between February and April 2021 were invited to the study. Eligibility criteria were that the parents were literate, fluent in Turkish, and had no major psychiatric or neurocognitive disorders that might interfere with reading comprehension. Parents who volunteered to participate in the study were referred to the child and adolescent psychiatry outpatient clinic by a pediatric endocrinologist. A child and adolescent psychiatrist informed parents that the study aimed to adapt a scale developed in a foreign language to Turkish to evaluate the parental stress of having an adolescent with type 1 diabetes, and they were informed about the scale to be completed. It was stated that some could be called again to fill in the same scale 3–4 weeks later. After all the information, only 200 of 228 parents who applied to the endocrinology outpatient clinic during 4 months were included in the study voluntarily by fulfilling the necessary conditions. The identity of the participating parents was kept confidential, and a child psychiatrist recruited the data filled in for the study.

It is recommended to verify the validity of the structure found in the Exploratory Factor Analysis (EFA) in a dataset with Confirmatory Factor Analysis (CFA) in a different dataset (Schumacker & Lomax, 2010). The literature states that a sample size between 100 and 200 is sufficient, especially when the factors are strong and distinct, and the number of variables is not too large in cross-cultural scale adaptation. As a general rule, it is also stated that the sample size should be between five and ten times the number of items. It was aimed to reach 200 participants, with 100 samples to be used in exploratory factor analysis and 100 samples to be used in confirmatory factor analysis. The scale contained 15 items. The number of hundred each participant we plan to include in the datasets is more than five times the number of items (Büyüköztürk, 2002; Tavşancıl, 2018). One of the authors administered the research questionnaire using the face-to-face interview method.

Measures

Questionnaire form

Researchers developed a questionnaire form to gather sociodemographic information about parents and clinical measures of their children's diabetes. Demographic information included child and parents' age, gender, education level, residency, family structure, and monthly income. Clinical measures included duration of diabetes, current diabetes treatment (insülin pumps or injections), the presence of severe complications requiring hospitalization in the past month ("yes" or "no"), and the current HbA1c level. Current values for HbA1c were measured by the clinician during the check-up and recorded in the questionnaire.

Problem areas in diabetes-parent version (PAID-P)

The 20-item Problem Areas in Diabetes-Parent Version (PAID-P) was first adapted by Antisdel (2000) modeling the original Problem Areas in Diabetes (PAID) (Polonsky et al., 1995) to assess parental diabetes-specific emotional distress. In 2014, the 26-item version of "Problem Areas in Diabetes- Parent of Teens' (P-PAID-T) was created, and accepted as the first original scale in recent literature (Weissberg-Benchell et al., 2014). Finally, the scale was transformed into its final version of 15 items P-PAID-T in 2017 (Shapiro et al., 2018).

The 15-item P-PAID-T is a 6-point Likert scale. The participants answer the items between "No problem-1" – "Severe Problem-6" according to how they felt about the scale items in the last month. There is no negatively scored item on the scale. The total score is calculated by the sum of the scores given to the Items. The scores that can be obtained from the scale range from 15 to 90. High scores are associated with increased diabetes-specific emotional distress levels. The P-PAID-T has no subscales. The total P-PAID-T Cronbach's α value was calculated as 0.95.

Procedure

After obtaining permission by mail from Jill Weissberg-Benchell (one of the authors), the forward and backward translation procedure was followed for intercultural adaptation of the scale. During this process, the recommendations of the WHO and the literature review on this subject were taken as a source (World Health Organization, 2009; Çapık et al., 2018) (Graph 1). The original scale was translated into Turkish by two bilingual Turkish health professionals. The translation scale was sent to the experts, and the content validity index (CVI) was calculated. This first translation was then translated back into the original language, English, by two bilingual native English speakers. The back translation scale has been sent to the corresponding author of P-PAID-T. The discrepancies between the back-and-forth translations were discussed in our board and a decision was made about the translation. The Turkish form was administered to 15 parents of children with T1DM as a pilot. Thirty parents of children with T1DM were tested-retested on the final version of the Turkish P-PAID-T. Test-retest reliability analysis was performed. Afterward, the data collection form and the Turkish P-PAID-T were applied to 200 parents of children with T1DM for the research. This study was approved by the Sivas Cumhuriyet University Non-Interventional Clinical Research Ethics Committee (with the 13.01.2021 date and 2021–01/22 number) in accordance with the Declaration of Helsinki. Before the study, the participants were informed about the study, and their consent was obtained.

Ethical considerations

After getting permission from the Ethics Committee of the university hospital, the eligible parents were selected by a pediatric endocrinologist and referred to a child and adolescent psychiatrist. The child and adolescent psychiatrist explained to the parents the purpose of the study and the scales to be completed. Parents also were informed that no payment would be made to them for participating in the study, that participation in the study was voluntary and that they could leave the study at any time, that no penal sanctions would be imposed in such a case, and that the identities of themselves and their children would be kept confidential during the study. Informed assent and consent forms were signed by the parents who volunteered to participate in the study. For the participants' privacy, their names were kept confidential and coded as 1,2,3. The scales completed by the parents were numbered and recruited only by the child psychiatrist. No other researchers had access to the participant's information.

Statistical analysis

SPSS for Windows Version 25 and IBM SPSS Amos 20 package programs were used for statistical analysis in the research. Normality analysis was performed with the Shapiro-Wilk test for numerical values. Descriptive statistical analyzes were calculated for sociodemographic data and items of the scale. Student-T was used to compare normally distributed numerical data between two categorical variables, and the ANOVA test was used to compare data between more than two categorical variables. The content validity study was evaluated with Davis Technique to test the scale's validity. Davis (1992) rates expert opinions on the technique as (a) "Appropriate," (b) "Needs minor revision," (c) "Needs major revision," and (d) " Not appropriate." In this technique, the number of experts who chose options (a) and (b) is divided by the total number of experts to obtain the "content validity index" for the item, and > 0.80 is considered as the suitability criterion for the item. Within the scope of the reliability analysis of the scale, the stability of the scale was determined by test-retest analysis. After reaching the sample number of 200, a random selection was made in the SPPS program to divide it into two different datasets to be used in Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) calculations. EFA is a statistical technique to detect latent variables (factors) underlying observed variables (Orçan, 2018). CFA tests the relationships between the observed variables and the structure or structures that are accepted to be measured through these observed variables (Wetson & Gore Jr, 2006). It is recommended to apply EFA first and then CFA in development studies. The order and form of using CFA may differ in adaptation studies (Kelloway, 1995). Our study was planned to adapt
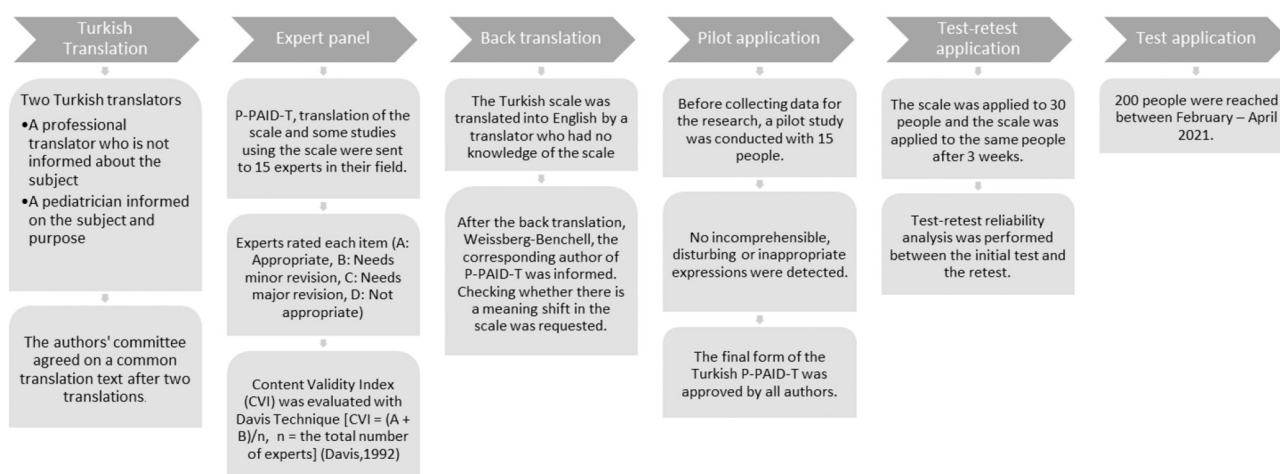
Graph 1. Intercultural adaptation stages applied in the research (WHO, 2009; Çapık et al., 2018).

the scale, so it was deemed appropriate to first use EFA and then CFA to detect semantic shifts that may arise from cultural reasons or incorrect translations (Orçan, 2018; Worthington & Whittaker, 2006). In Shapiro's study, two factors were calculated in the EFA analysis, and CFA could not confirm this structure (Shapiro et al., 2018). We took this study as an example and fixed it to 2 factors. EFA with oblique rotation, principal components, and direct oblimin methods were used to analyze the factor structure of the 15 items. Kaiser-Meyer-Olkin (KMO) and Bartlett tests were used. The fit indices examined to test the model fit of the CFA analysis; total variance values and factor loads, x2/df, comparative fit test (CFI), goodness fit test (GFI), normed fit index (NFI), non-normed fit index-Tucker Lewis index (NNFI-TLI) and root mean square error (RMSEA) values (Brown, 2006; İlhan & Çetin, 2014). The internal reliability analysis of the scale was analyzed with the Cronbach α test. A *p*-value of <0.05 was considered for statistical significance, with a 95% CI.

Results

Demographics

The parents of 200 teens with Type 1 DM participated in the study. The majority of the parents who participated in the study were mothers (*n* = 139, 69.5%), while 51.5% (*n* = 103) of the adolescents were girls. The sociodemographic characteristics of the participants are given in Table 1.

The relationship between the problem areas in diabetes-parents of teens scores with demographic data and diabetes characteristics

The comparison of the participants' P-PAID-T scores with their demographic data is shown in Table 2. The scale scores of those whose children were male, mothers, those who were unemployed, those who used insulin pens, and those with a university or higher education level were found to be higher than the others (*p* < 0.05).

No significant correlation was found between the P-PAID-T score and the adolescent's age, duration of diabetes diagnosis, or HbA1C level (*p* = 0.353, *r* = −0.066; *p* = 0.840, *r* = 0.014; *p* = 0.653, *r* = −0.032), respectively.

Content validity index and reliability

The evaluation results of fifteen experts who examined the Turkish translation of the scale were analyzed using the Davis Technique, and the Content Validity Index (CVI) was calculated. The CVI values of the items ranged from 0.86 to 1.0 (Table 3).

Afterward, thirty parents were tested-retested to evaluate the reliability of the scale. The correlation coefficients of the items on the scale ranged from 0.485 to 0.977. The correlation coefficient of the total scale was calculated as 0.977 (Table 4).

Exploratory factor analysis of the problem areas in diabetes-parents of teens scale

EFA with oblique rotation was used to analyze the factor structure of the 15 items. For this, principal components and direct oblimin methods are used. KMO = 0.841 and Bartlett's sphericity test results were χ2 = 928.324, *p* < 0.001. EFA analysis indicated two factors accounted for 57.61% of the variance. The contents of these two factors were examined, and the factors were named emotional burden and regimen-specific distress, like Shapiro's original scale. Rotation sums of squared loadings of these factors: emotional burden = 5.0, regimen-specific distress = 6.2. Factor loadings for the emotional burden factor ranged from 0.91 to 0.49, and for the regimen-specific distress factor from 0.89 to 0.38. In Table 5, factor loads are written according to the pattern matrix result of the 2-factor model. Factor loads <0.30 are not

Table 1
Adolescents' diabetes and the participants' demographic characteristics.

N = 200	M (*SD*)	n (%)
Teen Age (months)	169.4 (23.4)	
Teen Gender		
Female		103 (51.5%)
Male		97 (48.5%)
Parent		
Mother		139 (69.5%)
Father		61 (30.5%)
Living in		
Center		123 (61.5%)
Rural		77 (38.5%)
Education Level of Parents		
Primary and secondary education		130 (65.0%)
High school		37 (18.5%)
University and above		33 (16.5%)
Employment Status of Parents		
Employed		97 (48.5%)
Unemployed		103 (51.5%)
Family Structure		
Nuclear family		175 (87.5%)
Extended family		17 (8.5%)
Single (Divorced or dead)		8 (4.0%0)
Number of Children		
One		116 (58.0%)
More than one		84 (42.0%)
Monthly Family Income		
Minimum wage and below		63 (31.5%)
Above than minimum wage		137 (68.5%)
HbA1c %	9.2 (2.1)	
Duration of Diabetes (months)	43.6 (36.6)	
Presence of severe hypoglycemia in the last month (<50 mg/dl)		
Yes		46 (23.0%)
No		154 (77.0%)
Insulin Administration Method		
Pump		14 (7.0%)
Pen		186 (93.0%)
Additional Chronic Disease in Teen		
Yes		50 (25.0%)
No		150 (75.0%)

included in the table. According to the results, item 2 is included in factor 1, and item 13 is included in factor 2.

Confirmatory factor analysis of the problem areas in diabetes-parents of teens scale

CFA was used to assess the fit of the scale. Like Shapiro's study, this two factors model did not provide adequate fit (x2/df = 2.931, GFI = 0.736, CFI = 0.711, NFI = 0.628, NNFI = 0.660, RMSEA = 0.141). The internal reliability analysis Cronbach α value of the scale was 0.901. Item-total correlation coefficients were between 0.375 and 0.674. Since the α value for all items was above 0.80, it was decided that the scale was appropriate regarding content validity. The internal reliability analysis results of the scale are shown in Table 6.

Discussion

Parenting is difficult, but having a child with a chronic disease like T1DM is even more challenging and stressful (Cousino & Hazen, 2013).

Table 2

The comparison of the participants' P-PAID-T scores with their demographic data.

	P-PAID-T Score M (SD)	p
Teen Gender		
Female	47.9 (18.2)	**0.005**
Male	51.2 (14.2)	
Parent		
Mother	51.3 (16.4)	**0.020**
Father	45.5 (15.8)	
Living in		
Center	48.0 (15.6)	0.111
Rural	51.8 (17.5)	
Education Level of Parents		
Primary and secondary education	49.9 (17.7)	**0.015***
High school	44.3 (12.4)	
University and above	53.6 (14.0)	
Employment Status of Parents		
Employed	46.5 (15.4)	**0.013**
Unemployed	52.3 (17.0)	
Family Structure		
Nuclear family	49.1 (16.8)	0.621
Extended family	52.1 (14.7)	
Single (Divorced or dead)	53.3 (9.5)	
Number of Children		
One	49.7 (16.4)	0.822
More than one	49.2 (16.5)	
Monthly Family Income		
Minimum wage and below	52.3 (16.4)	0.105
Above than minimum wage	48.2 (16.3)	
Presence of severe hypoglycemia in the last month (<50 mg/dl)		
Yes	46.7 (16.1)	0.190
No	50.3 (16.5)	
Insulin Administration Method		
Pump	36.7 (17.1)	**0.002**
Pen	50.4 (16.0)	
Additional Chronic Disease in Teen		
Yes	48.7 (16.8)	0.709
No	49.7 (16.3)	

Post-hoc analysis: The difference between high school and university and above groups.

Table 3

The results of CVI on P-PAID-T using the Davis technique.

Expert N = 15	Appropriate	Needs minor revision	Needs major revision	Not appropriate	CVI
Item 1	14	1	0	0	1.00
Item 2	11	3	1	0	0.93
Item 3	14	1	0	0	1.00
Item 4	13	1	1	0	0.93
Item 5	10	3	2	0	0.86
Item 6	11	2	2	0	0.86
Item 7	12	2	1	0	0.93
Item 8	15	0	0	0	1.00
Item 9	14	1	0	0	1.00
Item 10	14	1	0	0	1.00
Item 11	14	0	1	0	0.93
Item 12	15	0	0	0	1.00
Item 13	15	0	0	0	1.00
Item 14	11	3	1	0	0.93
Item 15	10	3	2	0	0.86

CVI: Content validity index.

Especially if diabetes is diagnosed during adolescence, parents have to deal with the psychosocial, emotional, and financial burden of managing their child's diabetes medications and follow-up while also managing the conflicts of adolescence (Main et al., 2014; Saßmann et al., 2022; Shapiro et al., 2018). Parents may sometimes feel more anxious, fearful, self-doubt, helpless, and overwhelmed in managing (Bassi et al., 2020). When these feelings become excessive, they can affect the

Table 4

P-PAID-T Turkish version's test-retest reliability results.

	Test-retest reliability (Pearson's r)
Item 1	0.902**
Item 2	0.873**
Item 3	0.958**
Item 4	0.869**
Item 5	0.485*
Item 6	0.868**
Item 7	0.723**
Item 8	0.603**
Item 9	0.784**
Item 10	0.919**
Item 11	0.690**
Item 12	0.889**
Item 13	0.843**
Item 14	0.733**
Item 15	0.841**
Total	**0.977**

* <0.05

** < 0.001

parent's daily functioning, disrupt the parent-adolescent relationship, and cause family conflicts and mental disorders in the parent (Rybak et al., 2017). All of these factors can lead to impair diabetes management and deteriorate the course of the disease (Markowitz et al., 2012). Therefore, it's crucial to regularly monitor and periodically assess the mental health of parents of children and adolescents with T1DM.

In the present study, we conducted a Turkish validity and reliability study of the 15-item P-PAID-T scale to assess the above-mentioned problem areas in which parents of adolescents with T1DM struggle with diabetes management. Thus, we aimed to evaluate the diabetes-related stress of Turkish parents by using this scale and to ensure that healthcare professionals working in this field in our country have easy access to and apply it in daily practice.

The CVI index, which we measured using the Davis technique, ranged from 0.86 to 1.00 for each of the scale items. The fact that the CVI index of all items is above 0.80 can be interpreted as having content validity of the scale (Karagöz & Kösterelioğlu, 2008). We performed Cronbach alpha, item-total correlation, and test-retest correlation analyses as part of the reliability analysis of the scale. According to our test-retest results, the correlation coefficients of the items on the scale ranged from 0.485 to 0.977. The test-retest reliability of the total scale was 0.977. As a reliability test, item-total correlation analysis demonstrates the relationship between the scores obtained from the test items and the total score of the test. A value of 0.30 and above indicates that the items have a high discrimination rate. (Karagöz & Kösterelioğlu, 2008). Our study found that Item-total correlation coefficients were between 0.375 and 0.674. The internal reliability analysis Cronbach's α value of the Turkish version of the scale was 0.901, which was found to be 0.940 by Shapiro et al. (2018) and 0.93 in Saßmann et al.'s (2023) study. Thus, the Turkish version of the scale demonstrated strong reliability comparable to the original 15-item P-PAID-T.

To examine the factor structure of the 15 items, we used EFA with oblique rotation, resulting in KMO = 0.82 and Bartlett's test of sphericity χ^2 = 798.076, $p < 0.01$. The results of the KMO (>0.50) and Bartlett's test of sphericity that indicate our data was suitable for structure detection (Field, 2017). According to the EFA analysis, the two factors accounted for 57.61% of the variance. We named these two factors "emotional burden" and "regime-specific distress," as in Shapiro's original scale. After the model was estimated in Confirmatory Factor Analysis, the compatibility of the model with the observed variables was investigated, and our results; x2/df = 2.931, GFI = 0.736, CFI = 0.711, NFI = 0.628, NNFI(TLI) = 0.660, RMSEA = 0.141. Limit values accepted in the literature in the evaluation of goodness-of-fit results; the x2/df result is between 0 and 3, the GFI result is >0.90, the CFI result is >0.95, the NFI result is >0.90, the NNFI (TLI) result is >0.90, and the

Table 5
Factor loads according to the pattern matrix.

	Factor 1: Regimen-specific distress	Factor 2: Emotional burden
Item 5	0.892	
Item 6	0.826	
Item 15	0.777	
Item 1	0.762	
Item 9	0.753	
Item 4	0.629	
Item 10	0.624	
Item 3	0.600	
Item 2	0.384	0.367
Item 11		0.916
Item 12		0.872
Item 8		0.728
Item 14		0.575
Item 7		0.530
Item 13	0.359	0.497

Table 6
Cronbach reliability analysis of the Turkish version of P-PAID-T.

	Item total correlation	Cronbach's α if the item deleted
Item 1	0.505	0.897
Item 2	0.508	0.895
Item 3	0.522	0.897
Item 4	0.632	0.893
Item 5	0.579	0.895
Item 6	0.513	0.897
Item 7	0.638	0.892
Item 8	0.375	0.902
Item 9	0.636	0.892
Item 10	0.584	0.895
Item 11	0.674	0.891
Item 12	0.625	0.893
Item 13	0.586	0.894
Item 14	0.624	0.893
Item 15	0.633	0.893

RMSEA result is <0.1 (Baumgartner & Homburg, 1996; Schermelleh-Engel et al., 2003). Shapiro et al. (2018) CFA analysis to assess the fit of a second-order model with two first-order factors for the 15-item P-PAID-T scale using STePS data (SRMR = 0. 07, NNFI = 0.96, CFI = 0.97, RMSEA = 0.11), the two-factor model did not provide adequate fit in our study (x2/df = 3.956, GFI = 0.819, CFI = 0.809, RMSEA = 0.122). Our CFA results, like Shapiro's study, were interpreted as an insufficient fit of this two-factor model. It was deemed appropriate to evaluate the scale in one dimension, in accordance with its original form. In the German adopt study of the scale, the authors tried a two-factor model for EFA, but the subsequent CFA could not confirm the adequate fit of this two-factor model. They then tried a four-factor model as used in Hessler et al. (2016) and found an acceptable fit, but discriminant validity among constructs was low (Saßmann et al., 2023).

Shapiro et al. (2018) determined the cut-off value of P-PAID-T to be 54 using ROC curves. However, studies have suggested that it would be appropriate to interpret the scale based on the total score to measure parental distress (Evans et al., 2019). In our study, the mothers' P-PAID-T total score was 51.3, whereas the fathers' was 45.5. According to this, mothers experienced significantly higher levels of diabetes-related stress than fathers. Similar to our findings, many studies have revealed that mothers experience higher levels of diabetes stress than fathers. This discrepancy may result from mothers being the primary caregivers responsible for most daily diabetes-related tasks, which could be related to the higher parenting stress in mothers (Hansen et al., 2012; Nieuwesteeg et al., 2017; Streisand et al., 2008). The intense, stressful, and never-ending daily diabetes management may result in acute and severe complications in the slightest mistake and may cause stress for mothers who take most of the care responsibility (Nieuwesteeg et al., 2017). On the other hand, fathers who are more interested in households and spend time with their children in non-diabetes areas may explain why they experience less parenting stress than mothers (Nieuwesteeg et al., 2017; Sullivan-Bolyai et al., 2006).

We found a significant difference between the gender of the adolescent and the P-PAID-T score ($p = 0.005$). According to this, parents of sons experienced more diabetes-related stress, as in Hessler et al. (2016). This may be because male adolescents go through adolescence relatively more difficult and take less responsibility than female adolescents. Shapiro et al. (2018) did not find any relation between teen gender and parental stress. Saßmann et al. (2023) also found that parents' diabetes stress was not influenced by their children's gender. In our study, parents who used insulin pens showed higher levels of distress than those who used insulin pumps. Similarly, Hessler et al. (2016) determined that parents with teens using insulin pumps reported lower distress than those using insulin pens. We also determined that parents with a university or higher education level reported higher levels of distress than others. In Shapiro and Hessler's study, no significant difference was found between parents' educational level and parental distress (Hessler et al., 2016; Shapiro et al., 2018). Saßmann et al. (2023) also did not find any relation between parental education level and parental diabetes stress. Evans et al. (2019) conducted with the families of children aged 8–12 years with T1DM showed that parents with higher education levels had lower stress levels, in contrast to our findings.

We found no significant correlation between the P-PAID-T score and the adolescent's age, duration of diabetes diagnosis, family income, or HbA1C level. Shapiro et al. (2018) also found no significant correlation between adolescent age, family income, and years since diagnosis with parental diabetes stress. But they found a significant correlation between HbA1C level and parental distress like Markowitz et al. (2012) and Hessler et al. (2016). Similar to our finding, Jaser et al. (2017) did not find associations between parent distress and HbA1C level in their study. In their very recent German P-PAID-T adoption study, Saßmann et al. (2023) found that parental stress was positively correlated with HbA1c level and that parents with older children experienced less diabetes-related stress.

Strengths and limitations

Our study has several limitations. The first is that the study is cross-sectional and consists of data collected from a single center, so our sample cannot represent the whole of Turkey. Second, the retest test could only be applied to thirty people. This was a very small proportion of the study sample. The third and most important limitation is that as in the studies we frequently mentioned in the discussion section, data belonging to adolescents (PAID-T) were obtained in addition to P-PAID-T results, and the relationship between them was examined. In contrast, the PAID-T data were not included in our study. This is because we are conducting the validity and reliability study of the PAID-T study, which will be presented as an article.

The strengths of our study are the application of P-PAID-T to the parents in the presence of an interviewer, the simultaneous blood sampling from adolescents and measurement of Hba1c levels in the laboratory environment, and the inclusion of families from almost every socioeconomic level in the study. To the best of our knowledge, this is the first study of the 15-item P-PAID-T in a language other than the very recent German version. We believe that our study is very valuable in terms of being the second validity and reliability study conducted in another language and, in a way, confirming the previous study by Shapiro et al. and its contribution to the Turkish literature.

Implication for practice

Due to the possible adverse effects of parents' diabetes-related stress on parents' mental health, family functioning, and the prognosis of diabetes, nurses, and physicians working in the field should periodically measure and monitor the diabetes-related stress in parents. The 14-item Turkish P-PAID-T is a concise and well-assessment scale that physicians

and nurses working on pediatric endocrinology or child psychiatry in Turkey can safely use in their daily practice to evaluate parents of adolescents with T1DM, identify possible problems, and make necessary interventions. In addition, researchers can safely use the scale in clinical studies to determine the incidence of diabetes stress in parents with type 1 diabetes in our country or to examine parental stress in type 1 diabetes.

Conclusion

Many studies have shown that diabetes-related stress affects both parent's and children's mental health, daily functioning, quality of life, family relationships, and the course of the disease. Therefore, it is crucial to monitor this population at regular intervals and evaluate them regarding all risk factors. Conducting these assessments with scales that measure diabetes-specific problem areas, such as P-PAID-T, allows early interventions to identify and solve problems in a short time. Thus, the psychosocial well-being of parents is ensured, which facilitates diabetes management, improves glycemic control, and reduces diabetes-related poor health outcomes.

As a result of our study, the Turkish version of the 15-item P-PAID-T showed significant internal consistency and strong reliability. As such, the Turkish P-PAID-T is an easy-to-understand and practical scale that can be used safely in daily practice and clinical trials to assess diabetes-related parental distress in Turkish parents.

Ethics approval statement

We provided ethics committee approval with the 13.01.2021 date and 2021–01/22 number from the Ethics Committee of Sivas Cumhuriyet University.

Patient consent statement

We obtained written consent from all children included in the study and their legal guardians.

CRediT authorship contribution statement

Seda Aybuke Sari: Conceptualization, Methodology, Investigation, Writing – original draft, Visualization. **Ezgi Agadayi:** Methodology, Software, Formal analysis, Writing – review & editing. **Nurullah Celik:** Resources, Supervision, Writing – review & editing. **Seher Karahan:** Formal analysis, Investigation. **Ayça Komurluoglu Tan:** Resources. **Esra Doger:** Resources.

Declaration of Competing Interest

The authors declare that they have no conflict of interest.

Data availability

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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