SHORT THESIS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY (PHD)

Investigation of adherence in children and adolescents with type 1 diabetes in the context of age characteristics, family relationships, and psychological changes caused by the illness

by Brigitta Munkácsi

SUPERVISOR: BEÁTA ERIKA NAGY, Ph.D.

UNIVERSITY OF DEBRECEN

DOCTORAL SCHOOL OF KÁLMÁN LAKI

DEBRECEN, 2025.

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by Brigitta Munkácsi, clinical child psychologist

Supervisor: Beáta Erika Nagy, PhD

Doctoral School of Kálmán Laki (Thrombosis, haemostatis and vascular biology doctoral program), University of Debrecen

Head of the Defense Committee:

Zoltán Papp, PhD, DSc

Reviewers:

Anita Szemán-Nagy, PhD

János Kállai, PhD, DSc

Members of the Defense Committee:

Tímea Olajos, PhD

Dolli Mester, PhD

The PhD Defense takes place at the Lecture Hall of Bldg. A, Department of Internal Medicine, Faculty of Medicine, University of Debrecen at 1.00 p.m., 26th of March, 2025.

INTRODUCTION

Examining of the coexistence with chronic illness is one of the distinguished fields of health psychology today. This is especially true for type 1 diabetes (T1DM), which specifically requires continued adaptation to a life-threatening condition for which neither its cause nor its prevention, nor direct cure, is yet unknown. Nevertheless, it is very good to live with it, patients can develop a high degree of control over their physical condition. This particular experience of T1DM in a psychological sense is a significant adaptive task and a remarkable factor influencing personality development. This process is made particularly difficult by the body's ever-changing insulin needs - and its short- and long-term effects - which require constant alertness. In addition, chronic anxiety about the onset of a hypoglycemic condition may be present as a constant fear. As a result, there is often a major transformation of the parent-child relationship. The diagnosis of a chronic illness in children is often more difficult by the parents rather than the children, as this life situationis a major adjustment task at any age. In this case, the role of the parent and the primary emotional support is weakened and pushed into the background, as the shock caused by the illness - a state of crisis - temporarily causes the parent to be protected psychologically, and may involuntarily hand over parental role to the doctor. As a result, parents will be less able to perform the protective function that the child is accustomed to and expects, thus losing the child's main source of security and thereby reducing the chances of recovery. Proper maintenance of diabetes requires a high degree of self-control from both the child and the parent. It is therefore important to keep in mind that the need for rapid “learning” overrides all other - psychological - aspects.

AIMS

Our study consists of two major research parts, so we achieved our aims in two steps. The aim of the preliminary study was to develop a reliable and valid questionnaire that can be used in both children and adolescents, and that comprehensively covers the areas of adherence related to type 1 diabetes. We hypothesize that our adherence questionnaire is able to adequately identify the psychological characteristics and barriers of T1DM youth adherence. Pediatric Diabetes Adherence Questionnaire helps to examine the cognitive and emotional attitudes and factors influencing the adherence of young people with diabetes. None of the previous international questionnaires are available in Hungarian, so in Hungary, the comprehensive adherence questionnaire, which can be taken routinely, easily and, most importantly, quickly in everyday clinical practice, can greatly help to examine the adherence of T1DM children and

the factors influencing it as accurately as possible. As we have not found in the international literature a complex and detailed tool for examining adherence in children that includes therapeutic collaboration and all its possible influencing factors in a single questionnaire, we developed a diabetes-specific adherence questionnaire for children and adolescents in a preliminary study. The main goal of the research was to examine the psychological factors that play a role in the effective integration of coexistence with diabetes into everyday life and in collaboration with treatment. In this way, the obstacles of adherence, the factors related to the rejection of everyday treatment tasks - and often the unconscious ones - and the explanatory emotions and fears can be revealed. We were interested in examining the psychological difficulties, both in terms of age, mental well-being, and in terms of living with diabetes and in some aspects of working with treatment. This can identify psychological factors that may prevent proper glycemic control. The removal of these psychological barriers may be the subject of various psychological interventions in the future. Subsequently, an important objective of the main study was to assess the adherence, mental health, subjective well-being, illness representations, and interrelationships of T1DM youth. Thus, we would like to examine the development of adherence and glycemic control, as well as children's subjective well-being, mental health status. In addition, the research examines the illness representations of young people with diabetes and the relationships between these factors and mental health.

Hypotheses

H1: We hypothesize that T1DM youth are characterized by a worse mental state compared to their healthy peers. Young people with diabetes are characterized by significantly poorer subjective well-being, quality of life, more negative selfreported health and future prospects, and lower levels of life satisfaction compared to their healthy peers (Kristensen et al., 2014; Petrak, 2007; Winkley, 2006).

H2: The role of glycemic control is significant in the case of mental health and adherence, resulting in significantly worse adherence, subjective well-being, quality of life, more negative selfreported health and future prospects, and lower levels of life satisfaction among children with suboptimal glycemic control (Yaroscope, Chobot et al., 2000; Anderson et al., 1997).

H3: There is a significant relationship between mental health indicators and adherence. A lower level of adherence correlates with lower subjective well-being and quality of life, a more

negative selfreported health and future prospects, and a lower degree of life satisfaction (Amblee, 2016; Dailey et al., 2001; Murphy-Bennett et al., 1997; Plotnikoff et al., 2000).

H4: We hypothesize that the effect of treatment regimen is significant on the mental well-being of T1DM youth because significantly better mental health (adherence, subjective well-being, quality of life, self-esteem, social support, and higher life satisfaction) is better and more positive (Amblee, 2016; Siversten et al., 2014; Glaser et al., 2004).

H5: We hypothesize that the role of demographic variables in determining adherence of young people with diabetes is decisive: the adherence of girls, older people, those living in healthy families and parents with higher education was higher, as well as the positive effect of the larger settlement type, sibling presence and firstborn status. We also hypothesize that younger children, who were diagnosed earlier, who receive insulin pump therapy, who receive insulin pump therapy for a longer time, have better adherence (Dougherty, 2015; Lewin et al., 2006; Jaser, 2012; Dougherty, 2015; Streisand, Monaghan, 2014; Povey et al., 2005; Faulkner et al., 2007; Haugstvedt et al., 2011).

H6: We hypothesize that psychological well-being plays a significant role in the adherence of youth with T1DM, as subjective well-being, quality of life, selfreported health, social support, and higher levels of life satisfaction are associated with better adherence (Greening et al., 2006); Pikó, Keresztes, 2007; Fülöp, 2014; Munkácsi et al., 2018; Nagy, Kovács, 2017).

H7: Illness representations are positively correlated with mental health, however, there is a negative correlation between illness representations and the duration of diabetes (Havancsák et al., 2013; Gallup, 2016).

METHODS

Procedure

Presentation of the preliminary study

Development of the Pediatric Diabetes-Specific Adherence Questionnaire

As the first step of our research, we developed an adherence questionnaire to explore the therapeutic interactions of T1DM in children and adolescents and the factors influencing it. Following a review of the literature, we found ten relevant questionnaires that examined the adaptation of T1DM to diabetes and coexistence and lifestyle changes in children and adolescents, as well as adherence to some content. However, these questionnaires cover only some sub-areas of adherence. The researchers' approach is similar, but they take a different approach in terms of content, so the items of the 10 questionnaires were classified into content categories, and then the overlapping contents were omitted or merged, so there was no loss of content category. After sorting the content categories of the questionnaires used so far, we used a jury to finalize the content categories. The first version of the questionnaire was translated based on ten English questionnaires and then translated back into the original language, which included 167 statements in this form. The items were screened with the help of a ten-person specialist (psychologist) and a ten-person group of T1DM pediatric patients, resulting in the identification of nine subscales and then factor analysis to reduce the error threshold for accurate categorization. The reliability of our questionnaire was adequate (Cronbach-α = 0.769), as a Cronbach-α value above 0.6 is already considered acceptable. Based on these, we found our questionnaire to be appropriate for assessing diabetes-specific adherence in T1DM children.

Factor analysis of our questionnaire

Factor analysis was performed for statistical analysis. We examined how many independent factors the 167 items can be broken down into the total variance of the items to determine the number of scales. The strongest correlation shows which scale the item belongs to. Thus, factors were created by varimax rotation, from which the most interpretable ones were then selected. After rotation, it sorts the items by sorting the items that correlate highly with the first factor into a packet in descending correlation. Of the factors formed by Varimax rotation, the 9-factor variant was considered the best. Then we left the extraction values above 0.1 among the items, creating a well-interpretable factor structure with a satisfactory factor weight.

Presentation of the Pediatric Diabetes Adherence Questionnaire

The reliability of the 167 item complete questionnaire was very high (Cronbach $\alpha = 0.739$), however, it was very long to complete it, it took at least 60 minutes per person, so due to the children's attentional limitations and age characteristics, we designed a shorter but identical content questionnaire. The new abbreviated complex questionnaire was tested in 114 patients. We mapped the subscales sampled in the questionnaire by factor analysis, expecting the pattern following the nine subscales originally identified. As a result of the factor analysis, a 9-factor adherence questionnaire was obtained. Based on the factor analysis, a similar distribution was shown for the questions, including nine subscales (Selfmanagement, Diabetes-Specific Emotional Reactions, Social Support - Family, Social Support – Peers, Social Support - Medical Team, Disease Denial, Positive Adherence, Negative Adherence, Future prospects - Concerns). The reliability of both the subscales and the complete questionnaire (Cronbach-$\alpha = 0.881$) were adequate.

Sample

The research was based on the Diabetes Adherence Survey 2017 (DAF, 2017). The study was conducted partly at the Department of Pediatrics and Psychosomatics of the Department of Pediatrics of the Clinical Center of the University of Debrecen, and partly at some primary and secondary education institutions in Debrecen.

Children with type 1 diabetes

The T1DM children (N = 130) participating in the research were undergoing treatment at the Endocrinology Department of the Department of Pediatrics of the Clinical Center of the University of Debrecen at the time of the study. The research was carried out at the Department of Pediatrics and Psychosomatics of the Department of Pediatrics the Clinical Center of the University of Debrecen. Children and their parents in the study were informed in writing of the opportunity to participate in the study, its purpose, and its voluntary nature. The youngest child was 9 years old and the oldest was 18 years old, and the mean age of the sample was 14.17 years (SD = 2.18). Data collection took place between March 2016 and April 2017. 52.6% of the sample were boys (N = 60) and 47.4% were girls (N = 54). 67.5% of the sample lived in a full family, 21.9% lived with only one parent, and 8.8% live with foster parents. 16.7% had no

siblings, while 83.3% had at least one sibling. The mean age of children at the onset of the disease was 8.18 years (SD = 3.9); by the time of our research, the mean time since diagnosis of T1DM was 7.1 years (SD = 3.8). 43.9% of children use an insulin pump, while 56.1% receive conventional insulin therapy. The mean duration of insulinpump use in children receiving insulin pump therapy was 3.7 years (SD = 2.3).

Control group

Healthy children and adolescents (N = 256) in the study were randomly assigned to the study. Similar to the patient group, the members of the control group were informed in writing about their participation in the research, its methods, purpose, and volunteer nature. The examined children were recruited from the 9th and 12th grade students of the Gábor Bethlen High School and from the 5th and 8th grade students of the János Bolyai Primary School. The exclusion criterion was the presence of any chronic disease, so a total of 56 children were excluded. The mean age of the sample was 14.08 years (SD = 1.99).

Measures

A self-designed demographic questionnaire was used to assess the main socio-economic characteristics of the families. The battery of questionnaires included the following:

- Pediatric Diabetes Adherence Questionnaire, DAK-GY, Munkácsi, Nagy, Kovács, 2019
- Children Depression Inventory, (CDI), Kovacs, 1985, 1992; Rózsa és mtsai, 1999
- World Health Organization Well-Being Index (WBI-5, WHO)
- Selfrated health (SRH)
- Well-being and somatic symptoms (Pikó és mtsai, 1995; Pikó, 1998)
- Satisfaction with Life, SWL-present (SWL-p), SWL-future (SWL-f), Cantril-ladder, Cantril, 1965
- Pediatric Quality of Life Inventory, PedsQL Measurement Model (Varni, 1999)
- Satisfaction With Life Scale **(**SWLS**),** Martos, 2014
- Strengths and Difficulties Questionnaire; SDQ, (Goodman et al., 1998)
- Drawing version of Pictorial Representation of Illness Self-Measure, PRISM-D, Büchi, Sensky, 1999, Havancsák, 2013

- T1DM-specific factors

  The following factors were examined in children and adolescents with diabetes. HbA_{1C} is an accepted test parameter for glycemic control and the diagnosis of diabetes, and is currently the “gold standard” for long-term monitoring of glycemic control. The type of insulin therapy (multiple daily insulin regimen (MDI) / continuous subcutaneous insulin infusion (CSII)), the duration of diabetes, and the age at the onset of T1DM.

Statistical analyses

Statistical interpretation of the data was performed using the statistical program SPSS 22.0 for Windows. Data processing in each case began with conducting normality tests, as this determines whether parametric or non-parametric procedures are required. Differences between groups can be determined by a two-sample t-test for a normal distribution and by a Mann-Whitney test for a non-normal distribution. The correlation method was used to determine the correlations between the different variables examined, the Pearson correlation for the normal distribution and the Spearman rank correlation for the non-normal distribution. Linear regression analysis was used for impact analysis. A stepwise regression analysis was performed to map the complex interactions of the factors influencing adherence.

RESULTS

1. Comparison of mental health of T1DM and control group

To test our first hypothesis, we performed a comparison of mental and somatic health indicators in healthy and T1DM children using a two-sample t-test. Based on our results, there were significant differences in self-rated health status (SRH), mental well-being (WBI-5), frequency of somatic complaints, depression level (CDI), and quality of life (PedsQL) in terms of the emotional and the social functions. Children with T1DM had significantly higher subjective mental well-being (WBI) ($p < 0.001$), mental well-being ($p < 0.004$), lower levels of depression (CDI) ($p < 0.004$), and a lower frequency of somatic complaints ($p = 0.03$) compared to the control group. However, the selfrated health status (SRH) of the control group was significantly higher ($p < 0.001$). We also examined health-related quality of life (PedsQL) among the T1DM and control groups. Regarding physical functions, the results of the T1DM group were higher, but the difference between the two groups was not significant ($p = 0.819$). In contrast, there was already a significant difference in emotional function ($p = 0.008$), with higher values in T1DM youth. A similar value can be seen for school function in favor of T1DM youth, the difference was significant ($p = 0.049$). However, in the case of social function, the control group showed a higher efficiency, the difference between the two groups was significant ($p = 0.042$). There was no significant difference between the two groups in terms of overall quality of life ($p = 0.47$). We found a significant difference in life satisfaction (SWL-p) ($p = 0.048$), with the T1DM group reporting significantly higher life satisfaction. However, this significant difference was no longer present for the future prospects (SWL-f), for the assumed condition after 5 years ($p = 0.732$). Summarizing the results of testing our first hypothesis, it can be stated that there was a significant difference between mental well-being (WBI-5) ($p < 0.001$), mental well-being ($p < 0.004$), frequency of somatic complaints ($p = 0.03$), and for depression level (CDI) ($p = 0.004$), but contrary to hypothesis, children with T1DM reported better outcomes. In their case, we found a better health-related quality of life (PedsQL) in terms of emotional and social functions, and a higher degree of life satisfaction (SWL-p) was observed among them, however, this difference in future prospects (SWL-f) was no longer significant. However, the score on the Quality of Life (PedsQL) school functions subscale was higher in the control group. This can be explained by our experience that children with T1DM have to deal with a number of barriers to proper selfmanagement

of their diabetes at school (e.g. meals at the right time, measuring blood sugar in the community, appropriate correction of any fluctuations in blood sugar levels during lessons, etc.). Thus, our first hypothesis was not confirmed, the opposite of our assumption was justified.

2. Relationships between glycemic control, mental health and adherence

In the case of our second hypothesis, we assumed significantly worse adherence among children with suboptimal glycemic control and more negative results in terms of children's health indicators. Next, the correlation system of glycemic control was reviewed. Diabetes status was determined based on ISPAD recommended glycemic control target numbers: HbA_{1C} <7% for optimal metabolic control, 7-9% for suboptimal control, and over 9% for high-risk metabolic control (Lukács, 2013). The mean HbA_{1C} values of T1DM children in our sample were 8.32% (SD = 1.53), which belongs to the suboptimal category for the ISPAD reference zones. 14.3% of T1DM children fell into the optimal group, nearly 60% into the suboptimal group, and 25.9% into the high-risk glycemic control group.

Relationship between diabetes-specific factors and adherence

Spearman rank correlation was performed to examine the relationship between diabetes-specific factors and adherence. Our results showed a significant association between glycemic control (HbA_{1C}) and the Social Support - Medical Team subscale, with no significant relationship between the other subscales and the total adherence score. Examining the correlations between adherence and other diabetes-specific factors, we found a significant positive correlation between the duration of T1DM and the Social Support – Peers subscale, so children with a longer history of T1DM scored significantly higher on this subscale, based on their evaluation, living with diabetes has less of a negative impact on their peer relationships. Adherence was also examined by the age at the time of diagnosis of T1DM. There was a significant correlation between the total adherence score ($r = -0.298$, $p = 0.002$), the Selfmanagement ($r = -0.266$, $p = 0.006$), the Social Support - Family ($r = -0.316$, $p = 0.001$), and the Positive Adherence ($r = -0.226$, $p = 0.019$) and the Future prospects - Concerns ($r = -0.234$, $p = 0.015$) subscales.

So, the later T1DM was diagnosed, the lower the overall adherence score, and the lower the level of selfmanagement were, and the less supportive their family was reported, and the more concerns about the future were assumed.

The relationship between diabetes-specific factors and mental health

One of the main aims of our research was to investigate the two sides of the phenomenon of therapeutic cooperation among T1DM youth. This was done by examining mental health indicators based on subjective self-reporting, as well as HbA_{1C} values, which provide objective information on the average blood sugar level over the past three months.

Correlations between diabetes-specific factors and mental health indicators were examined using Spearman's rank correlation. No significant association was found between glycemic control (HbA_{1C}) and mental health indicators. However, there was a significant positive association between the duration of T1DM and self-rated health status (SRH), children with a history of T1DM reported significantly better self-rated health. Presumably, as the children and parents become able to develop adaptive coping strategies over time, the ability to regain control over somatic health and a sense of control may play a significant role in children's positive self-rated health.

Relationships between glycemic control, quality of life, and emotional and behavioral symptoms

No significant association was found between health-related quality of life (PedsQL), emotional and behavioral symptoms (SDQ), HbA_{1C} level, and other diabetes-specific variables based on the results of the Spearman rank correlation.

Relationship between glycemic control and diabetes-specific variables

Analyzing the correlations between HbA_{1C} level and diabetes-specific variables, we found a significant positive correlation ($r = 0.21$; $p = 0.022$) between the duration of glycemic control and the duration of T1DM, the longer the T1DM has been present, the higher the the mean HbA_{1C} levels were.

There was no significant relationship between the age at the onset of T1DM and HbA_{1C} levels ($r = -0.127$; $p = 0.496$) based on Spearman rank correlation results. Overall, based on our results, glycemic control was not significantly associated with either adherence or mental health, so our second hypothesis was not justified.

3. Relationships between adherence and mental health

Descriptive statistics for the mental health status and adherence of T1DM children and adolescents

The average number of depression (CDI) in the sample was 8.53 (SD = 5.96), among the boys were 7.2 (SD = 5.08), and 9.7 (SD = 6.09) for girls. There was no significant difference between gender (U = 958.00; p = 0.056), but the girls achieved a higher average value. 75.5% of children belonged to a risk-free zone. 24.5% of children were classified in the depression risk group. 11.76% were characterized by a clinical depressed mood.

The Self-reported health status (SRH) of T1DM children was 2.74 (SD = 0.69). Children reported 60% good and 26.36% of adequate, 9.09 of them excellent, while 4.55% of them considered their health status very bad. The aggregate of T1DM children's satisfaction with their life (SWL) was 6,98 (SD = 1.89) and the average of their future prospects was slightly higher, 8.13 (SD = 1.66). There was no significant difference between mental health factors and diabetes-specific variables.

Relationships of the adherence and the mental health

According to our results, there has been a significant correlation both the total number of adherence, both adherence subscales and depression (CDI), frequency of somatic complaints, with life satisfaction (SWLS, SWL-P), mental well-being (WBI), self-assessed quality of life (PEDsQL) and for emotional and behavioral symptoms (SDQ).

The total number of adherence questionnaires showed a significant correlation with children's self-assessed mental health indicators, while not with parental evaluations. The strongest correlations with the Depression (CDI) score, with life satisfaction (SWLS), subjective well-being (WBI), the frequency of somatic complaints, self-

assessed quality of life (PEDsQL) and self-assessed emotional and behavioral symptoms (SDQ). T1DM children who reported higher adherence score, have achieved a lower depression (CDI) score, had a better self-reported health status (SRH) and satisfaction with life (SWLS-P) and a more positive future prospects (SWLS-F) and reported rarer somatic complaints. With regard to health-dependent quality of life (PEDsQL) and emotional and behavioral symptoms (SDQ), the higher adherence score has been correlated with more positive quality of life and milder emotional symptoms and behavioral problems.

We found several significant correlations in the subscales of the Diabetes Adherencia Questionnaire and the depression. Depression was correlated with the Diabetes-specific emotional reactions, Social support - Peers, Social support - Medical team, Negative adherence and Future prospects – Concerns subscales. Among them, the strongest cohesions were the Social support - Peers and Future prospects – Concerns. That is, children have reported significantly lower depression levels who have been emotionally less affected by their handling tasks, and who believed that living together with diabetes was less negatively influenced by their contemporary relations, and who considers that medical team is reliable and supportive, and for whom treatment tasks are less reported restrictions for their daily lifestyle, and who were less worried about that T1DM negatively affects their future life.

In point of SWLS, there was a significant relationship with each subscales. The most significant correlations were found with the Selfmanagement, the Social support - Family, the Negative adherence and the Future prospects – Concerns subscales. So, who reported a higher level of satisfaction with selfmanagement, evaluated their families as more supportive, and in their case fewer diabetes-specific restrictions and concerns have been reported.

Subjective well-being (WBI) was significant correlated with all three dimensions of the Selfmanagement, the Social support (Family, Peers, Medical team), and the Negative adherence and Future prospects – Concerns subscales. So, who have been significantly more positively evaluated their well-being, they have had a higher level of self-assessment (based on their self-esteem), their families and their relationship with the medical team have been evaluated as more supportive, less perceived living together with T1DM as a factor of limiting everyday life and they reported fewer future concerns about the diabetes.

Looking at the correlations of adherence and self-assessed quality of life (PEDsQL), we found a significant relationship for all Diabetes Adherence Questionnaire subscales with the exception of Disease denial. For example, the emotional state of children had significantly correlated with the Diabetes-specific emotional reactions, Social support - Family and Peers dimensions, Negative adherence and Future prospects – Concerns. So, those with a better emotional state reported less negative diabetes-specific emotional reactions and fewer diabetes-specific concerns about the future and based on their assessment, living together with diabetes is less restrict their everyday life.

4. The relationships of insulin therapy, glycemic control, mental health and adherence

Type of insulin therapy and glycemic control (HbA_{1C})

In the case of insulin therapy, there was no significant difference between the two groups ($p = 0.319$) for glycemic control according to the results of the Mann-Whitney test. The average HbA_{1C} of the children receiving MDI therapy was 8% and 8.1% of children receiving CSII therapy.

The relationship of the type of insulin therapy and mental health indicators

Examining the relationship of the type of insulin therapy and mental health indicators, it has been found that children received CSII therapy has reported significantly better health-dependent quality of life (PEDsQL) and mental well-being (WBI), and lower depression (CDI) levels than those who received MDI therapy.

In the case of the depression score, the average number of children receiving CSII therapy was 7.42, while 10 points for the members of the control group, the difference between the two groups was significant ($p = 0.027$). In view of the further contexts of the used insulin therapy and the depression, 38.64% of the children in the MDI group were in the depression risk group ($CDI \geq 12$), while 15.9% have fallen in clinical depression zone. Only 17.24% of children receiving CSII therapy have fallen into the depression risk group, while 3.45% have fallen in clinical depression zone.

As regards the satisfaction with life (SWL-P) and the Future prospects (SWL-F), the CSII group has achieved a higher score, the difference between the two groups was significant (SWL-P: $p = 0.050$; SWL-F: $p = 0.03$).

T1DM children's quality of life depending on the insulin therapy

For general health-dependent quality of life (PEDsQL), the CSII group was achieved ($p = 0.02$) significantly higher average value ($p = 0.02$): children receiving MDI therapy achieved 74.56, while children receiving CSII therapy achieved 78.42 average number. With regard to the subscales of the health-dependent quality of life, the CSII group achieved a higher score for physical health, social relationships and school activity as the MDI group, but significant difference was only found in the social function ($p = 0.03$). There was no significant difference in the emotional condition. In the case of the quality of life reported by parents, there was no significant difference between the two groups.

T1DM children's adherence depending on the type of insulin therapy

The CSII group has achieved a significantly higher score for Diabetes-specific emotional reactions and Social support - Peers subscales than the MDI group. Based on our results, in the case of CSII therapy, diabetes-specific emotional reactions are less negative and significantly less perveive living together with diabetes as a restrictive factor that negatively affects their peer relationships. Our results confirm that the type of insulin therapy shows a significant link with the T1DM children mental health and psychological well-being. Children receiving CSII therapy reported significantly greater satisfaction with life and future prospects, and rare somatic complaints, lower score of depression, more satisfaction with their body image. With regard to adherence subscales, less negative diabetes-specific emotional reactions have been reported and living together with diabetes has been observed as less negatively affecting their peer relationships than their counterparts receiving MDI therapy. Overall, it can be concluded that the use of CSII therapy is significantly more effective in both mental health indicators and quality of life and adherence, so based on our results the fourth hypothesis has been justified.

5. The relationship between the sociodemographic factors with glycemic control, mental health variables and adherence

The relationship between sociodemographic factors and glycemic control

There was no significant gender difference (Z = -0.95; p = 0.34) for glycemic control. There was no significant relationship between glycemic control and age. There was no significant difference between the groups of family structure, parent's education level, the subjective socioeconomic status and the number of siblings in terms of glycemic control.

The relationship between sociodemographic factors and mental health indicators

Depression (CDI) (Z = -2.27; p = 0.02) was found to be a significant difference between the mental health indicators, the frequency of somatic complaints (Z = -2.45; p = 0.01), self-assessed (z = 2,801; p = 0.005) and the quality of life authorized by the parent (PEDsQL) (Z = -2.084; p = 0.037). The girls reported significantly higher levels of depression were characterized by significantly more frequent somatic complaints than boys, selfreported quality of life were worse, while the parents of the girls evaluated their quality of life better, and their emotional and behavioral symptoms less serious than boys.

The relationship between sociodemographic factors and adherence

In our final model, we investigated the type of insulin therapy, the age at the T1DM diagnosis and the role of the time elapsed since the beginning of the CSII therapy. In the case of the type of insulin therapy used, there was a significant effect (p = 0.045). The adherence of children receiving CSII therapy was higher compared to their peers receiving MDI therapy. In addition, the age at the onset of T1DM had a significant effect (p = 0.035), which was negative, so the younger age was, the higher the adherence point number. The average adherence of patients diagnosed before the age of 12 was 187.9 points, while the average adherence of patients diagnosed after 12 years was 177 points and the difference between the two groups was significant (p = 0.039). The time elapsed

since the beginning of CSII therapy did not show any significant effect on adherence ($p = 0.945$). The average adherence by children receiving insulin pump therapy for more than 4 years was 187.9 points, while in the case of receiving insulin pump therapy shorter than 4 years, the average was 185.7 points and the difference was not significant ($p = 0.625$). Overall, therefore, in the case of sociodemographic variables, there was no significant effect, but according to our results, the type of insulin therapy and the age at onset of T1DM diagnosis have a significant impact on children's adherence.

6. Investigating the psychological factors affecting the adherence

Stepped regression analysis was performed to examining complex interactions of psychological factors influencing adherence. In the initial model, 15 independent variables were included than potentially adherence influencing factors. The initial model contained variables of illness representation as the size of the illness circle (Illness Perception Measure, IPM), the distance of the Illness-circle and the Self-circle (Self-Illness Separation, SIS), and the total number and size of the circles. Mental health variables were also involved as selfreported health (SRH), depression (CDI), life satisfaction (SWLS), mental well-being (WBI-5), somatic complaints, health-dependent quality of life (PedsQL), emotional and behavioral symptoms (SDQ) and diabetes-specific variables. The ultimate and most powerful model of the backward step regression analysis contained four, significantly adherence influencing factor. Illness representation variables (PRISM-D test) illness circle and the distance (SIS indicator) and the number of circles shown in the drawing test, glycemic control (HbA_{1C} value) and the child-assessed quality of life (PEDsQL) result in an explanatory force of 67.2% in the evolution of adherence ($R^2 = 0.672$). We identified a negative correlation with the distance of Self- and Illness-Circle (SIS), so the closer the child represented the illness-circle for itself, the better the adherence values were reported. In the other three variables, positive correlations were identified: the more resource-symbolizing circle were represented, the better quality of life were evaluated and the higher HbA_{1C} values were reported, the higher degree of the adherence was.

7. The relationship between illness representations with adherence and mental health status

The relationship between illness representations and adherence

Looking at the contexts of the illness representations and adherence, based on our results, the score achieved on the subscale of the Future prospects - Concerns has significantly negative correlated with the following variables: the size of the illness circle (IPM) ($R = -0.046$; $p = 0.004$), with the aggregate size of circles outside the illness circle ($r = -0.012$; $p = 0.001$), as well as the aggregate size ($r = -0.0309$; $p = 0.019$) of the content of the „significant others" content category. The statistical test was the one-variable linear regression analysis. That is, the higher the score of the Future prospects – Concerns, the smaller the size of the illness-circle, and in the case of a cumulative area of circles outside the illness circle and the aggregate area of the circles belonging to the „significant others" content category. There were any significant correlations between the aggregate score of the Diabetes Adherence Questionnaire and illness representations.

Relationships between mental health and illness representations

We hereby examine the circles represented besides the illness circle and then the contents of these, which were classified in the following categories based on their frequency. The most common content category was the "significant others" (54.4%), followed by "leisure activities" (20.63%) and then "future prospects, goals" (15.5%) and finally the "school" (6%) content category occurred. However, 14.16% of the children did not show significant relationships, and 61% of them did not represent leisure activities or hobbies. 9.73% did not show significant relationships or leisure activities or hobbies on the drawing test. Besides the illness circle, 8.85% represented further diabetes contents and two children represented only diabetes contents. Children who have not represented significant relationships have higher depression scores than those who represent at least one important personal relationship ($U = 379{,}000$; $p = 0.01$). In addition, significantly fewer circle were drawn besides the illness circle ($U = 305{,}000$; $p < 0.01$) and the cumulative size of these circles were significantly smaller ($U = 607{,}500$; $p < 0.05$). There was also a significant positive correlation with the size of the circles of "significant others" and the size of the illness circle ($r = 0.360$; $p < 0.01$), the

number of circles besides the illness circle ($r = 0.325$; $p < 0.01$) and their aggregate area ($r = 0.744$; $p < 0.01$). Based on our results, children who represented bigger circles of "significant others", represented significantly larger illness circle, and the number of circles besides the illness circle and their aggregate area were also greater. In the case of other content categories there was no significant relationship with the factors of mental health conditions.

Looking at the contexts of depression and illness representations, we have found that the number of circles besides the illness circle ($r = -0.220$; $p < 0.05$) and the size of the circles of "significant others" ($r = -0.253$; $p < 0.05$) showed a significant correlation with CDI scores. In addition, there was a significant correlation between the number of circles belonging to the content category "significant others" and the CDI scores ($r = -0.181$; $p = 0.069$). There was no significant correlation between illness representations and other mental health factors (SRH, SWL-P, SWL-F).

Overall, it can be concluded that we met with diverse content categories reported during the PRISM-D drawing test. Of the four categories obtained during the content analysis, "significant others" were the most common. From this we can conclude that personal relationships with family members and friends play an outstanding role in T1DM children's life and serve as a decisive protective factor for their mental health status as well. In children who did not show significant relationships at all, they probably do not have significant personal relationships, and there was a significant increase in the risk of depression. Examining this nonverbal drawing test, it was also demonstrated that a protective factor in the development of depression is a priority in the child's life support, social support, that is, actually secure binding with the caretaker. The more negative emotional-mood status of children also manifested in less and smaller size of the circles. Children who have achieved a higher depression score, on the one hand, have been drawn significantly less circle (besides the illness circle) and, on the other hand, the number and size of the circles in the category "significant others" were significantly lower. It can therefore be said that the fewer resources are present in a child's life, the less protected against the development, aggravation and consequences of a depressive mood.

DISCUSSION

1. Comparison of the mental health of T1DM and control group

Children with chronic illness, the risk of emotional and behavioral problems is enhanced (Lavigne, Faierroutman 1992; Siversten et al., 2009). This relationship was confirmed by epidemiological and clinical trials (Cadman et al., 1987). Parents detect their children to be strongly vulnerable and the overprotective parenting attitudes can negatively affect the personality development, the emotional status and behavior of children with chronic illness. The experience of coexistence with chronic illness can therefore often be associated with symptoms of emotional and behavioral problems. For T1DM children and adolescents, the risk of psychological disorders is increased, which can contribute to inadequate adherence, and glycemic control (Kakleas et al., 2009). The most common comorbid mental disorders in T1DM children are depression, anxiety disorders and behavioral disorders (Almeida et al., 2018; Wändell, Carlsson, 2014). Children with comorbid psychopathology are less capable of T1DM for psychological adaptation to new life situations that may have a negative impact on treatment-related adherence and glycemic control (Bernstein, 2013; Ducat et al., 2014). Another important starting point for our research was the international research results that, despite the fact that most of the adolescents living with type 1 diabetes do not reach the optimal glycemic regulation (Petitti, 2009; Silverstein, 2005), no psychological measuring device exist (Cox, 2014; Lemanek, 2001). According to our knowledge, there is no complex international questionnaire - in Hungary there is no diabetes-specific adherence measuring instrument at all - which could serve to examine both the selfmanagement and the psychological factors influencing it. Thus, in our research, we have created a new and complex measuring instrument on the basis of the available English language questionnaires that are able to examine the diabetes-specific adherence. The reliability, validity and internal consistency of this is appropriate, so it can be used among children and adolescents. Type 1 diabetes as chronic, based on the current state of science, incurable somatic health status, the presence of negative mental healthcare indicates when comparing healthy peers. However, the results of our research are somewhat to rise to the existence of this tendency. Although there was a significant difference between the two groups, the frequency of subjective somatic complaints, the level of depression and the health-

related quality of life, but contrary to the assumption, children living with diabetes have been more effective. In the background of this, a kind of more stable, more flexible internal resources can be assumed. After all T1DM children must learn to live with a chronic, incurable disease, which, if successful, based on the phenomenon of post-traumatic growth can result in significant additional resources and mastery of effective coping strategies. This positive effect may also be reflected in the other mental health indicators (Murillo et al., 2017).

2.-3. Relationships of glycemic control, mental health and adherence

Many researches demonstrate that most of the T1DM adolescents fall outside the glycemic control target range (Anderson et al., 2007; Lemanek, 2001; Weinger et al., FoO and Mtsai, 2017). According to Tonella et al. (2010), a small part of the examined children belonged to the corresponding glycemic control range provided by the ISPAD. According to their results, the aggregate HbA_{1C} value of the children was 7.6% (7.0 / 8.3) expressed in median (25/75 percentile). It was 7.4% (6.9 / 8.1) and 7.7% (7.2 / 8.5) for younger prepubert-aged children, and 7.7% (7.2 / 8.5) for older adolescents. Interestingly, however, no significant difference was found in the HbA_{1C} values depending on the type of insulin therapy. Overall, according to the results of the non-adherence surveys, the non-adherent behavior is between 20 and 93% (Wysocki, 2005). In line with international results, it has been found that the average HbA_{1C} value was 8.32 ± 1.52%, the majority of children, 72.32% fell outside the optimal glycemic control target range. The Danish Children's Data Register (2009) also concluded that the target range was not achieved for 69% of Danish adolescents. In accordance with the results of Silverstein et al. (2005), who found suboptimal glycemic controls for more than 50% of children, 45.53% of our sample belonged to this group. Like the results of Petitti et al. (2009), where 17% of the adolescents had inadequate glycemic control, according to our results, 26.79% of the examined children have fallen into this category. The HbA_{1C} average value received in our research is consistent with international results. It can also be seen that the average value of 8.32% of our research is slightly higher than the average of the Swedish sample (7.6%), but below the US (8.4%) and Hvidore research (8.9%) its mean values. With regard to our results, it can be concluded that the assumption was confirmed that the HbA_{1C} value of the Hungarian T1DM youth is outside the reference zone.

Glycemic control can be influenced by several factors, including biological and psychosocial characteristics as well (e.g. family support). Many studies have examined the relationship between diabetes-specific family factors, adherence and metabolic control. The relationship between various aspects of family management (specifically for the treatment of diabetes) and glycemic controls have been justified. Parent's positive emotional support - understanding of the difficulties of the treatment regimen and the expression of compassion - was correlated with better metabolic control (Waller et al., 1986). Greater diabetes-specific family support associated with significantly better glycemic control. The assessment of subjective socioeconomic status was not significantly related to glycemic control, but the age and the duration of diabetes was. The results of the longitudinal examination of Jacobson et al. (1994) also supported the correlation between appropriate family communication and better metabolic control. In addition, the parental guidance associated with diabetes care has shown a positive correlation with better diabetes-specific health indicators, such as metabolic control (Waller et al., 1986). Several studies have confirmed that patients reporting more family conflicts show poorer adherence and glycemic control (Miller-Johnson et al., 1994). Schafer et al. (1983) and Schafer, McCaul and Glasgow (1986) found that negative and non-supporting parental behaviors (such as coercion, war, threats, criticism, scolding) were demonstrated with both poor glycemic control and inappropriate compliance with the treatment regimen. According to Anderson et al. (2007), adolescents who reported significantly fewer parent-child conflicts with respect to diabetes management had better metabolic control. Many studies have shown that family conflicts and negative interactions were the strongest predictive factors of inappropriate adherence (Anderson et al., 2007; Hauser et al., 1990; Schafer et al., 1986). Furthermore, the impact of family structure should also be emphasized to the degree of perceived family support and glycemic control (White, 1984). The recurrent ketoacidosis was twice as many of those who had single parent or step parent. According to the results of Marteau et al. (1987), children who live with both or at least one biological parent have a significantly better glycemic control than those who live with a stepmother. In terms of the effects of siblings on metabolic control and perceived family support, it was found that children without siblings and with biological siblings considered significantly more positive the parental care than those who lived with half- or stepmothers, but no differences were found in the case of HbA_{1C} values. However, when two groups were created (with and

without siblings), there was a significant difference, so children without siblings had significantly better glycemic control.

4. The relationships between the type of insulin therapy, the glycemic control, the mental health and the adherence

Our results are in line with previous research confirming that children receiving conventional insulin therapy had higher depression levels and more negative self-assessed and characterized by severe emotional and behavioral symptoms by their parents. According to the results of SEARCH research, the use of conventional insulin therapy and inadequate glycemic control (> 9%) have led to lower quality of life among T1DM children (Naughton, 2008). In relation to the adherence depending on the insulin therapy, it was found, that children receiving CSII therapy has achieved a significantly higher score on the Diabetes-specific emotional reactions and Social support – Peers subscales. In their case, performing the tasks associated with diabetes management was less associated negative emotions and their peer relationshipd were less restricted and influenced by diabetes negatively.

5. The relationship between the sociodemographic factors with glycemic control, mental health variables and adherence

Investigating the relationship between adherence and glycemic control and socio-demographic factors it was found that the total score of adherence and it's subscales scores and HbA_{1C} values did not have a significant correlation with sociodemographic factors. However, in the case of mental health factors, girls had significantly higher depression levels and they reported more frequent somatic complaints and worse quality of life than boys. However, parental quality of life assessment was significantly worse in the case of boys. The higher depression levels was demonstrated by several researches in T1DM adolescent girls (Nolen-Hoeksema, Girgus, 1994). Comorbid depressive symptoms may significantly contribute to the decline in adherence among teenage girls. This result is especially important for the adherence and the possibility of developing serious complications due to the poor glycemic control. Adolescence is a period of developmental psychology of special significance also in the sense that the behavioral

patterns of therapeutic cooperation present at this age stage are likely to remain stable in adulthood. Thus, depression can be identified as a significant risk factor for poor diabetes values, especially for adolescent girls. This effect can be observed on the selfreported adherence but not on the metabolic control. The result of La Greca et al. (1995) is that depression is present as a mediating factor for gender differences in metabolic control, but does not appear in the case of adherence, although the use of different test tools in different studies makes it difficult to compare results. In addition, glycemic control can be influenced by a number of additional factors in addition to adherence and even in adolescence may be particularly labile due to hormonal transformations. This biological background instability may mask the negative effect of depression on metabolic control (Evans et al., 2020). Our results that gender and age were not associated with either therapeutic cooperation or metabolic control are consistent with the research of Korbel et al. (2007). However, while they did not find a gender difference in depression, our results showed that girls had a significantly higher depression level than boys as well as according to HBSC research (2018). However, by gender, T1DM girls had a significant negative relationship between age and glycemic control. According to Hassan et al. (2006), the association between poor glycemic control and depression is higher among those with lower socioeconomic status. Poor glycemic controls correlated with lower socioeconomic status and higher depression levels. The likelihood of depression increased by decreasing glycemic control. Regarding the gender differences in therapeutic cooperation, the boys achieved significantly higher score for adherence total score, Diabetes-specific emotional reactions and Future prospects - Concerns subscales, but they did not have significantly better metabolic control than girls. In our interpretation, therefore, boys scored significantly higher on total adherence scores, Diabetes-specific emotional reactions, and Future prospects - Concerns subscales, however, they did not have significantly better metabolic control than girls. In addition, their glycemic control was closer to the reference zone specified by ISPAD. Our findings are consistent with international results, adolescent girls typically show a poor metabolic control and characterized by less appropriate therapeutic cooperation (Campaigne et al., 2000, Williams et al., 1998). Such gender differences are likely to reflect the diversity of changes in adolescence (Pojskic, Eslami, 2018). A higher number of diabetes-specific family conflicts were associated with less frequent blood glucose selfmonitoring and poorer glycemic control. Families that argue more about a child's diabetes are likely to face more barriers in the

case of adherence. The longitudinal relationship between family characteristics (e.g. diabetes-specific conflicts) and glycemic control has been demonstrated. Based on our results, it can be concluded that the impact of demographic background variables was not significant and the difference between groups was not significant. In the case of siblings, we can see that although the adherence of children with siblings is higher compared to children without siblings, the effect of siblings is not significant on the adherence. In the case of the role of age, it can be said that although its effect on adherence is not significant, the adherence of children under 14 years of age is significantly lower compared to their older peers, which confirms previous findings of the literature (Hellegeson, 2009; Thomas et al, 1997). The effect of the time elapsed since the diagnosis was not significant, but the type of the insulin therapy was significant and positive, and the adherence of children using insulin pump was clearly higher. In addition, the age at the onset of T1DM was showed a significant negative effect, suggesting that the younger the age at the onset of T1DM is diagnosed, the greater the child's adherence. Adherence of children diagnosed before the age of 12 was significantly higher than the adherence of children who was diagnosed after the age of 12, and the difference between the two groups was significant. However, the time elapsed since the beginning of the insulin pump therapy did not show any significant effect on the adherence.

6. Investigating the psychological factors affecting adherence

Nonadherence-related factors have been identified by a number of researches, these are classified into three groups: (1) the characteristics of medical treatment, (2) the characteristics of the disease and (3) the factors associated with the children / family. The literature confirms that there is significant association between poor adherence and several characteristics of the medical treatment, such as longer disease duration, complexity of the treatment regimen, changes in lifestyle, side effects and uncertain efficacy of the treatment (Baharvand, Hormoz, 2019). The inconsistent behavior of medical team and parents can also contribute to poor adherence among adolescents (Lemanek, 2001). According to Rapoff and Barnard (1991), in the case of the disease-specific factors, there was significant association between nonadherent behavior, younger age at onset of the disease, and family-perceived severity of the disease. According to Hood et al. (2006), emotional reactions related to blood glucose

monitoring showed a significant negative relationship with the quality of life, so the children showed a more negative emotional reaction, the worse quality of life were characterized. According to the results of Korbel et al. (2007), there was a significant negative association between the duration of T1DM and adherence, so the longer duration of diabetes was associated with poorer adherence and metabolic control. Kovacs et al (1995) also found that the younger age at diagnosis was a risk factor for poor adherence, as well as medical and psychological problems.

According to our results in the case of the illness representations, we identified a negative correlation between the distance of the Self-circle and the Illness-cirle, so the closer the child represented these circles, the better the adherence value was reported. Positive correlations were found for the aggregate result of the child's assessed quality of life (PedsQL), the number of circles represented in the PRISM-D drawing test beside the Illness-circle, and the HbA_{1C} variables: the more circles were represented besides the Illness-circle symbolizing the psychologycal resources of the children, the better they rated their own quality of life, and the higher their HbA_{1C} values were, the higher adherence they reported.

7. The relationship between illness representations with adherence and mental health status

During the PRISM-D drawing test we identified diverse meaning contents. Of the four content categories identified by the content analysis, "significant others" was the most common. So we can conclude that personal relationships with family members and friends play a prominent role in T1DM children's life. In children who did not show significant relationships at all, they probably did not have relevant personal relationships, which could serve as a resource for them, and the risk of depression was significantly higher. The more negative emotional status of children also manifested in less and smaller size of the circles. T1DM children who have achieved a higher depression score, on the one hand, have been drawn significantly less circle (beside the illness circle) and, on the other hand, the number and the size of the circles in the category "significant others" were significantly lower. Therefore it can be said that the fewer resources are present in a child's life, the less protected against the development of depression (Evans et al., 2020; Munkácsi et al, 2022).

With the results of Havans and Mtsai (2013), we found a positive relationship between the areas of the illness circle and the "significant others" circles and the size of the circles beside the illness circle. The higher the size of the illness-circles were, the higher the size of the circles symbolizing resources were. This can be explained by the fact that the more prominent the patient's awareness of his illness, the more they need support, so the increase in circle size can be explained by the possible mediating effect of anxiety. According to the results of previous research, in the case of patients with different diseases anxiety was correlated in a positive direction with a larger size of the organs (Broadbent et al., 2004, 2006, and Mtsai, 2012). Anxiety can be reduced through the various psychodynamic modes of oppression (e.g. denial, removal) and by strengthening coping (Havancsák, 2013).

With regard to diabetes specific variables, mental health variables and illness representations, children who have been diagnosed earlier, represented significantly closer the illness-circle to the self-circle, but at the same time reported a higher degree of self-reported health than their later diagnosed peers. From this we can conclude that over the years, the living of diabetes as a chronic illness, after the initial emotional shock, can convert from a life-threatening disease with compulsive-coercive restrictions, can be transformed into a kind of accepting cohabitation. The distance between the centers of the Illness- and Selfcircles refers to the degree of subjective suffering caused by the disease. In their study of cancer-treated adults, Sándor and Csabai (2018) found a greater distance between the Self- and the Illness-circle, which was explained by suffering from a high degree of the disease. In this research, in the case of T1DM children, we found a slightly smaller distance between the center of the two circles, however, based on this, the degree of suffering from the diabetes is not negligible either. Examination of illness representations can enrich the work of T1DM children with important and new aspects. As the specific conceptual thinking ability associated with verbality only stabilizes after the age of ten, it is much easier for children to express their feelings, desires, and fears through nonverbal means such as drawing. The PRISM-D drawing test was the first to use children and even a special chronic patient group - to explore the illness representations of children living with type 1 diabetes and to examine the correlations of the various disease-specific factors or health indicators. Along the complex knowledge of T1DM children's illness representations, their psychotherapy can become more effective, which can positively influence their

quality of life and mental health. Based on our results, we recommend using the PRISM-D among the T1DM population and other children suffering from chronic illness. Using the test, it is easier to reveal the extent of the suffering caused by living with diabetes, and we can get a more complex picture of children's perception of living together with the diabetes, their emotional status, and their available resources, which are great assistance in both their individual and group psychotherapy (Munkácsi et al, 2022).

CONCLUSION

The present research is one of the few studies in the literature on the psychological examination of children with chronic illness, which comprehensively examined the relationship between glycemic control and self-reported adherence, as well as mental health status and illness representations in children and adolescents with type 1 diabetes. The relevance of our topic is given by the fact that the incidence of childhood diabetes is constantly increasing worldwide, nevertheless, adherence and comprehensive psychological examination of the psychological factors influencing it, are often overlooked in international research. In Hungary, despite the importance of proper adherence as a key factor in long-term health care, a negligible number of studies have been conducted to examine children's adherence and mental health status. However, more accurate understanding of psychological factors associated with non-adherent behavior can significantly improve the possibility of medical team to provide care adapted to the psychological needs of children and their families. Better understanding and comparing the mental health of children and young people with T1DM diagnosis and healthy peers can be considered as relevant information from a practical aspect. It is remarkable that young people diagnosed with diabetes are more effective than their peers in certain aspects of mental health, which may suggest a more effective, elaborate coping mechanism. Coping with a chronic illness is a long and difficult process, but if it succeeds, it is able to raise a person for a qualitatively stronger and higher level. This finding may also be significant for other populations with chronic illness. Although the mechanism may be disease-specific, however, however, in terms of its fundamentals, it arises and develops from the same problem. In this process, the relevance of the environment’s role is unquestionable, which can be captured in the adherence as well.

The role of glycemic control on the basis of international research results should also be highlighted, although in this research it was less manifested. It is necessary to emphasize the importance of continuous monitoring of the HbA_{1C} level, as disregarding this may lead to physical complications, which may be negative in the case of mental health and adherence too. Regarding to insulin pump therapy, according to the literature, it would be assumed that adherence will also increase (Pickup, 2019; Amblee, 2016; Siversten et al., 2014; Glaser et al, 2004). It would be important to apply our Adherence Questionnaire in children living with diabetes, as we can gain important aspects, through it we can gain important aspects that greatly help their psychological leadership. Thus, psychological intervention, supportive psychotherapy can be implemented more specifically for the children and their family. In the case of demographic background variables, in this research, the effect of gender, family structure, siblings, and order of birth, parents education level and the type of settlement were not significant. The date of diagnosis is critical, as it can be seen that the younger the age at which T1DM is diagnosed, the greater the degree of adherence. The younger the age at which diabetes develops, the easier it is for children with even more resilient, formable personalities to "penetrate" the condition, accept it, develop and maintain a proper lifestyle, and develop the resources needed to cope properly. The peculiarities of the relationship between health indicators show that positive indicators are closely, supportively, and positively related to other positive health indicators, while they are negatively correlated with negative health indicators (e.g. depression). All this can be demonstrated in the present research, and adherence was in the same relationship with positive health indicators and in the opposite direction with negative health indicators. Accordingly, positive health indicators strengthen therapeutic collaboration and negative indicators weaken it. For this reason, it is necessary to highlight the issue of mental health and to provide support for the health of children with diabetes, to support it with health prevention programs and, if necessary, intervention.

Examination of illness representations allows for a qualitatively different, more complex and illustrative exploration compared to traditional selfassessment measures. Its repeated use provides an opportunity to monitor the condition of children, thus providing a more accurate picture of the child's current experience of living with diabetes, the related emotional and mood status, and the available resources and coping. Our findings suggest that a significant reduction in the case of adherence and metabolic

control in adolescence definitely requires significant clinical attention. It is important to emphasize that new treatment methods and approaches are needed in view of the complexity of T1DM adolescence. In order to improve glycemic control in adolescents, it is essential to involve both parents and the health team - through a constructive relationship that supports the young person's autonomy - which can lead to more effective diabetes self-management without compromising the adolescent's individual responsibilities.

SUMMARY

One of the main aims of our research was to investigate the mental health status in children and adolescents with type 1 diabetes, as well as a comparison with healthy peers regarding to subjective well-being, selfreported health, subjective psychosomatic symptoms, quality of life, future prospects, body image, life satisfaction and depression. Children participating in the research were cared by the Faculty of Medicine Institute of Pediatrics Department Clinical Center of the University of Debrecen. Another important objective of our research was the widespread mapping of children's adherence. Based on the hungarian and international literature, no complex diabetes-specific child's adherence questionnaire has not yet been developed. To this end, a complex questionnaire with 9 subscales was created with standard test development in the preliminary testing phase.

We also found an important aspect of assessing and comparing the psychological characteristics of children with diabetes and healthy peers. This will give us a more accurate picture of the psychological characteristics of living with diabetes and its possible positive effects as well. Age at the time of diagnosis of diabetes may also play a significant role: the onset of diabetes at an early age prior to adolescence may have a more positive effect. Furthermore, as the type of insulin therapy used plays a prominent role in the care of diabetes, we considered it relevant to examine this aspect by comparing the specifics of conservative therapy and insulin pump therapy. We also examined children's mental health indicators and adherence within the grouping based on the type of insulin therapy. Based on previous results of the literature, we have expected the higher efficacy of insulin pump therapy to be considered as a new treatment method.

In the second part of our research, various sociodemographic and psychological factors influencing adherence were examined. Significant effect was assumed for gender, age, parental education, type of settlement, siblings, diabetes-specific variables such as duration of T1DM or type of insulin therapy. In addition, the effect of previously examined psychological factors on adherence was examined. We assumed the positive impact of subjective well-being, quality of life, selfreported health, life satisfaction and future prospects, however, a negative effect was expected in the case of depression and subjective somatic complaints.

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Subject: PhD Publication List

Candidate: Brigitta Munkácsi
Doctoral School: Kálmán Laki Doctoral School
MTMT ID: 10055254

List of publications related to the dissertation

1. **Munkácsi, B.**, Felszeghy, E. N., Kenyhercz, F., Nagy, B. E.: Examination of the illness representations among children with T1DM in relation to mental health factors.
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3. Nagy, B. E., **Munkácsi, B.**, Kovács, K. E.: Mental Health, Adherence, and Self-Management Among Children with Diabetes.
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DOI: http://dx.doi.org/10.1556/OH.2014.29966

Total IF of journals (all publications): 2,736
Total IF of journals (publications related to the dissertation): 2,239

The Candidate's publication data submitted to the iDEa Tudóstér have been validated by DEENK on the basis of the Journal Citation Report (Impact Factor) database.

03 October, 2024

DEBRECENI EGYETEM Egyetemi és Nemzeti Könyvtár

National and international conference presentations and posters

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